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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-16698 Engineering Sciences Data Unit, London (England).

DRAG OF TWO DIMENSIONAL STEPS AND RIDGES IMMERSED IN A TURBULENT BOUNDARY LAYER AT SUBSONIC AND SUPERSONIC SPEEDS

Oct. 1973 22 p refs Sponsored by Roy. Aeron. Soc.

(ESDU-73028) Copyright. Avail: Issuing Activity CSCL 01A

Equations and curves are developed for the conditions created by subsonic and supersonic airflows about an obstruction in the air stream, using a range of obstruction heights. The obstructions were mounted on a floating-element drag balance which was inserted into the wind tunnel wall. The obstructions were effectively of infinite span, end effects being avoided by means of extensions fixed to the wind tunnel wall. The aerodynamic drag coefficients represent the loads on the obstruction itself plus any changes in skin friction on the balance plate due to the presence of the obstruction, less the skin friction on any part of the plate covered by the obstruction. Author

N74-16699*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

BOUNDARY CONDITION PROGRAM FOR AERODYNAMIC LIFTING SURFACE THEORY

Richard T. Medan and K. Susan Ray (Computer Sciences Corp., Mt. View, Calif.) Nov. 1973 67 p refs

(NASA-TM-X-62323) Avail: NTIS HC $5.50 CSCL 20D

Users manual for a U.S.A. FORTRAN 4 computer program which determines boundary conditions for a thin wing lifting surface program is described. This program, the geometry program, and several other programs are used together in the analysis of lifting, thin wings in steady, subsonic flow according to a kernel function lifting surface theory. The program calculates specific types of boundary conditions automatically such as those necessary to determine pitch and roll damping derivatives. The program also accepts descriptions of the camber or downwash and twist in the form of tables and/or coefficients of equations. The program performs interpolations so that tables and/or coefficients can apply at stations selected by the user and not at stations dictated by the control point locations. Author

N74-16700*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EQUATION SOLVING PROGRAM FOR AERODYNAMIC LIFTING SURFACE THEORY

Richard T. Medan and Opal J. Lemmer (Computer Sci. Corp., Mountain View, Calif.) Jan. 1974 91 p refs

(NASA-TM-X-62325) Avail: NTIS HC $7.75 CSCL 01A

A description of and user's manual are presented for one of a group of FORTRAN programs which, together, can be used for the analysis and design of wings in steady, subsonic flow according to a kernel function method lifting surface theory. This particular program is the one which solves the sets of simultaneous, linear, algebraic equations arising from the thin wing analysis. This program has the capability of striking out rows and columns of the aerodynamic influence matrix and rows of the associated boundary condition vectors (right hand sides). This capability significantly enhances the effectiveness of the kernel function method of lifting surface theory because studies of the convergence of solutions with the number of control points can be done with the calculation of only a single influence matrix. Author

N74-16701*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INFLUENCE MATRIX PROGRAM FOR AERODYNAMIC LIFTING SURFACE THEORY

Richard T. Medan and K. Susan Ray (Computer Science Corp., Mountain View, Calif.) Dec. 1973 62 p refs

(NASA-TM-X-62324) Avail: NTIS HC $6.25 CSCL 01A

A users manual is described for a USA FORTRAN 4 computer program which computes an aerodynamic influence matrix and is one of several computer programs used to analyze lifting, thin wings in steady, subsonic flow according to a kernel function method lifting surface theory. The most significant features of the program are that it can treat unsymmetrical wings, control points can be placed on the leading and/or trailing edges, and a stable, efficient algorithm is used to compute the influence matrix. Author

N74-16702*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESEARCH TURBINE FOR HIGH TEMPERATURE CORE ENGINE APPLICATION. 1: COLD-AIROVERALL PERFORMANCE OF SOLID SCALED TURBINE

Edward M. Szanca, Harold J. Schum, and Glen M. Hotz Washington Feb. 1974 31 p refs

(NASA-TN-D-7557; E-7592) Avail: NTIS HC $3.00 CSCL 20D

A solid, half-scale model of a 50.8-cm (20-in) research turbine designed for a high temperature core engine application was investigated over a range of speeds and pressure ratios. The results of this test are presented. The effect of rotor blade twist was also investigated. At the design equivalent speed and specific work output, the total efficiency of the turbine with untwisted rotor blades was 87.1 percent; at the same pressure ratio the efficiency of the turbine with twisted rotor blades was 88.0 percent. Author

N74-16703*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A RAPID NUMERICAL SOLUTION TO SUBSONIC FLOW OVER PLANAR AND AXISYMMETRIC PROFILES AT AN ANGLE OF ATTACK OF 0 DEG

Vincent R. Mascitti Washington Mar. 1974 33 p refs

(NASA-TN-D-7410; L-8904) Avail: NTIS HC $3.25 CSCL 01A

A numerical solution is presented for the incompressible flow over thin planar and axisymmetric profiles at an angle of attack of 0 degrees. The method uses a finite-difference field solution to the governing equation with a Gauss-Seidel successive overrelaxation scheme. However, the use of a simple Cartesian grid system restricts this method to slender profiles. Results are presented for a cambered airfoil, airfoil in wall effect (two-dimensional flowthrough inlet), body of revolution, and flowthrough nacelle. A computer program is presented which can be used for any of the previously mentioned cases with simple input changes. Results for compressible flow are available with the use of the appropriate two-dimensional or axisymmetric compressibility corrections. Computational time for a typical field calculation of 3000 grid points and 200 cycles through the field is less than 1 minute with less than 50,000 octal storage on the Control Data Corporation 6600 computing system. Author

N74-16704*# Wisconsin Univ., Milwaukee.
NUMERICAL CALCULATIONS OF VELOCITY AND PRESSURE DISTRIBUTION AROUND OSCILLATING AIRFOILS
Theodore Bratanow, Akin Ecer, and Michael Kobiske Washington NASA Feb. 1974 86 p refs
(Grant NGR-50-007-001)
(NASA-CR-2368) Avail: NTIS HC $4.00 CSCL 01A

An analytical procedure based on the Navier-Stokes equations was developed for analyzing and representing properties of unsteady viscous flow around oscillating obstacles. A variational formulation of the vorticity transport equation was discretized in finite element form and integrated numerically. At each time step of the numerical integration, the velocity field around the obstacle was determined for the instantaneous vorticity distribution from the finite element solution of Poisson's equation. The time-dependent boundary conditions around the oscillating obstacle were introduced as external constraints, using the Lagrangian Multiplier Technique, at each time step of the numerical integration. The procedure was then applied for determining pressures around obstacles oscillating in unsteady flow. The obtained results for a cylinder and an airfoil were illustrated in the form of streamlines and vorticity and pressure distributions. Author

N74-16705# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
COLLECTION OF EXPERIMENTAL DATA FOR AIRCRAFT AFTERBODY DRAG IN THE TRANSONIC AND SUPERSONIC RANGE AND COMPARISON WITH THEORETICAL CALCULATION METHODS [ZUSAMMENSTELLUNG EXPERIMENTELLER UNTERLAGEN ZUM HECKWIDERSTAND VON FLUGKOERPERN IM TRANSSCHALL- UND IM UEBERSCHALLBEREICH UND VERGLEICH MIT THEORETISCHEN BERECHNUNGSMETHODEN]
W. R. Schmidt and E. Herpfer Bonn Bundeswehramt Apr. 1973 118 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-27) Avail: NTIS HC $9.00; Bundeswehramt 30 DM

For non-boattailed afterbodies, mean value curves are determined for two- and three-dimensional flows. For the three-dimensional flow, the influence of the following parameters on the afterbody (without jet influence) is discussed and represented graphically: free stream Mach number, afterbody contour, nose contour, fineness ratio of the overall configuration, Reynolds number, angle of attack, boundary layer thickness, sting geometry, afterbody angle, and base-to-cylinder diameter ratio. The effect of the following jet parameters on the afterbody drag is described by a computer program and compared with experimental results: ratio of nozzle exit pressure to free stream pressure, nozzle-to-base diameter ratio, nozzle exit angle, jet Mach number in nozzle exit, ratio of specific heats of jet propellant, base bleeding, free stream Mach number, afterbody angle, and afterbody length. Author (ESRO)

N74-16706# Technische Hochschule, Aachen (West Germany). Stosswellenlab.
EXPERIMENTAL INVESTIGATION OF TEMPERATURE AND PRESSURE DISTRIBUTION ON HYPERSONIC VEHICLES [EXPERIMENTELLE UNTERSUCHUNG DER TEMPERATUR- UND DRUCKVERTEILUNG AN HYPERSCHALLKOERPERN]
H. Groenig and H. Schumacher Bonn Bundeswehramt Jan. 1973 56 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. Fuer Verteidigung
(BMVg-FBWT-73-28) Avail: NTIS HC $6.00; Bundeswehramt 30 DM

The heat transfer of two models of reentry bodies was measured at free stream Mach 6,61 in a shock tunnel. The models consisted of a lifting body and an elliptical half-cone. Pressure and heat transfer measurements on a standard transition model have shown that no natural transition can be expected under the test conditions used. Wires and rods were therefore used as trips to introduce transition artificially. The experimental results indicate an increase in heat transfer due to tripping. Schlieren photographs exhibit the downstream flow distortions introduced by these elements. Author (ESRO)

N74-16707# National Aerospace Lab., Amsterdam (Netherlands).
CALCULATION OF THE DISPLACEMENT EFFECT IN TWO-DIMENSIONAL SUBSONIC ATTACHED FLOW AROUND AEROFOILS. EXAMPLES OF CALCULATIONS USING MEASURED DISPLACEMENT THICKNESSES
W. J. Piers and J. W. Slooff 8 May 1972 40 p refs Sponsored by the Directorate of Materiel Air, Roy. Neth. Air Force
(NLR-TR-72116-U) Avail: NTIS HC $5.00

Using measured displacement thickness, the classical displacement effect on lift and pressure distribution was calculated for a number of air foils in viscous attached flow. For this purpose the displacement concept boundary condition was incorporated in a potential flow calculation method that uses a discretized surface singularity distribution. Comparisons between results of the present calculations and experimental values of lift confirm earlier findings that the classical displacement concept tends to underestimate the total viscous lift loss, especially in cases with large trailing edge angle. This illustrates the need to take more appropriate care of the singular behavior of the flow near the trailing edge. Author (ESRO)

N74-16708# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
QUASI HOMOGENEOUS APPROXIMATIONS FOR THE CALCULATION OF WINGS WITH CURVED SUBSONIC LEADING EDGES FLYING AT SUPERSONIC SPEEDS Ph.D. Thesis
Rene Coene Feb. 1973 180 p refs
(VTH-173) Avail: NTIS HC $12.00

A method is developed for the calculation of supersonic wings with planforms characterized by curved subsonic leading edges. The method extends the range of applicability of Germain's and Fenain's homogeneous flow theory, which is valid for supersonic wings with straight leading edges. With boundary conditions at the wing surface and leading edges of polynomial form, the boundary value problems can be reduced to algebraic problems which permit a systematic treatment. Author (ESRO)

N74-16709# Aerospace Corp., El Segundo, Calif.
EQUILIBRIUM SHAPE OF ABLATIVE NOSE TIPS IN HYPERSONIC FLOW
Harold Mirels 26 Nov. 1973 47 p refs
(Contract F04701-73-C-0074)
(AD-770579; TR-0074(4240-10)-8; SAMSO-TR-73-372) Avail: NTIS CSCL 16/3

A unified theory is presented for the equilibrium (self preserving) shape of an ablative nose tip in a hypersonic flow. Purely laminar, purely turbulent, and partly laminar-partly turbulent boundary layers are considered. Blunt profiles and both blunt and slender profiles are deduced for the purely laminar and the purely turbulent boundary layer regimes, respectively. For cases where the nose tip boundary layer is partly laminar and partly turbulent, it is assumed that the scale of the laminar portion of the nose tip is defined by a known transition Reynolds number Ret. The resulting nose shape is blunt in the laminar region and slender in the turbulent region, and is called a laminar-slender turbulent profile. (Modified author abstract) GRA

N74-16710# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
USE OF THE ANALOG COMPUTER IN THE STUDY OF

THE EFFECTS OF AERODYNAMICS ON BALLISTIC TRAJECTORY M.S. Thesis
John A. Wiles Dec. 1972 66 p refs
(AD-770081; GAW/MC/73-1) Avail: NTIS CSCL 19/4

A study was made to see if the analog computer could be programmed in such a manner that it became a useful tool for the weapons design engineer in his analysis of free-fall bomb trajectories. The equations of motion were derived for the two-dimensional trajectory of a bomb, including pitching motion about the nominal flight path. The aerodynamic forces and moments were generated on the computer by means of nonlinear components. Several trial runs were made and it was determined that the accuracy of the analog solution, when compared to an equivalent digital solution, was sufficient for a first order analysis of trajectory variations. The use of the program was demonstrated by varying static margin and initial angle of attack and observing the resultant changes in the ground range of the bomb. The program is more versatile than this, however, and can be used to observe all trajectory phenomena while varying any of the physical or aerodynamic parameters. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-16711 Georgia Inst. of Tech., Atlanta.
HELICOPTER BLADE-TIP STABILITY IN FORWARD FLIGHT Ph.D. Thesis
Keith Waldo Shipman 1972 132 p
Avail: Univ. Microfilms Order No. 73-29022

A method for determining rotor blade flutter in forward flight is presented, developed, and applied in this thesis. The unsteady effects of the layers of the helical wake below the rotor are accounted for. Since the blade tangential velocity, and consequently, the aerodynamic damping vary with azimuth, the vorticity shed due to blade oscillations incipient to flutter will be contained within a region on either side of a critical azimuth position. Assuming this region to be small allows the wake system to be two-dimensionalized. The left deficiency function developed from the new theory is simplified for limiting cases and compared with earlier results obtained for fixed wings and helicopters in hover. It is found to be consistent with earlier results when simplified. The theory is then applied to bending-torsion flutter for the tip segment of a rotor blade. The previously shed wakes are found to be destabilizing. The flutter velocity becomes constant at higher advance ratios. Dissert. Abstr.

N74-16712 Kansas Univ., Lawrence.
AN OPTIMAL CONTROL APPROACH TO AIRPLANE STABILITY AUGMENTATION SYSTEMS DESIGN Ph.D. Thesis
Omar H. Mardam-Bey 1973 198 p
Avail: Univ. Microfilms Order No. 73-30839

Airplane stability augmentation systems have been conventionally designed by using frequency domain techniques of control systems design. With the advances made in the field of optimal control systems, it became necessary to investigate the quality of stability augmentation systems that can be designed by using optimal control. The present work provides an optimal control method by which airplane stability augmentation systems can be designed, and a major objective of the approach is to provide an easily implementable stability augmentation system. An outline of the design procedure is presented. The airplane equations of motion are written in state space form as a linear, time-invariant state equation. Next, the airplane performance, and its desirable response to pilot commands, are described mathematically by a quadratic performance index. The performance index formulation is primarily based on the physical understanding of the airplane performance requirements. Dissert. Abstr.

N74-16713 Technischen Universitaet, Munich (West Germany). Inst. fuer Flugmechanik.
ITERATIVE SUBSYSTEM METHOD FOR PARAMETER CALCULATION OF EQUATIONS OF MOTION SYSTEM FROM FLIGHT TEST DATA [ITERATIVES UNTERSYSTEM-VERFAHREN ZUR BERECHNUNG DER PARAMETER EINES BEWEGUNGSGLEICHUNGSSYSTEMS AUS FLUGVERSUCHSMESSUNGEN]
H. U. Schaeufele Sep. 1973 59 p refs In GERMAN
Avail: Issuing Activity 20 DM

Aircraft flight motions can be described by differential equations with constant coefficients. A method to determine these coefficients from variables of state and control variables measured during a flight is described. The coefficients obtained, using the least squares method, are improved by an iterative method which leads to an algorithm similar to the modified Newton-Raphson method and the quasilinearization method. The numerical calculation is substantially simplified by transforming part of the variables of state into variables with properties of control variables. This produces an iteractive subsystem method in which smaller and simpler differential equation systems, compared to the modified Newton-Raphson method and the quasilinearization method, have to be solved. ESRO

N74-16714*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RATIONAL FUNCTION REPRESENTATION OF FLAP NOISE SPECTRA INCLUDING CORRECTION FOR REFLECTION EFFECTS
J. H. Miles 1974 30 p refs Presented at 12th Aerospace Sci. Meeting, Washington, D. C., 30 Jan. - 1 Feb. 1974; sponsored by AIAA
(NASA-TM-X-71502; E-7869) Avail: NTIS HC $3.50 CSCL 01C

A rational function is presented for the acoustic spectra generated by deflection of engine exhaust jets for under-the-wing and over-the-wing versions of externally blown flaps. The functional representation is intended to provide a means for compact storage of data and for data analysis. The expressions are based on Fourier transform functions for the Strouhal normalized pressure spectral density, and on a correction for reflection effects based on the N-independent-source model of P. Thomas extended by use of a reflected ray transfer function. Curve fit comparisons are presented for blown flap data taken from turbofan engine tests and from large scale cold-flow model tests. Application of the rational function to scrubbing noise theory is also indicated. Author

N74-16715*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC CHARACTERISTICS OF EXTERNALLY BLOWN FLAP SYSTEMS WITH MIXER NOZZLES
Jack H. Goodykoontz, Robert G. Dorsch, and Jack M. Wagner [1974] 26 p refs Presented at the twelfth Aerospace Sciences Meeting, Washington, D. C., 30 Jan. 1 Feb. 1974; sponsored by AIAA
(NASA-TM-X-71499) Avail: NTIS HC $4.50 CSCL 01B

Noise tests were conducted on a large scale, cold flow model of an engine-under-the-wing externally blown flap lift augmentation system employing a mixer nozzle. The mixer nozzle was used to reduce the flap impingement velocity and, consequently, try to attenuate the additional noise caused by the interaction between the jet exhaust and the wing flap. Results from the mixer nozzle tests are summarized and compared with the results for a conical nozzle. The comparison showed that with the mixer nozzle, less noise was generated when the trailing flap was in a typical landing setting (e.g., 60 deg). However, for a takeoff flap setting (20 deg), there was little or no difference in the acoustic characteristics when either the mixer or conical nozzle was used. Author

N74-16716*# General Electric Co., Pittsfield, Mass.
A TEST TECHNIQUE FOR MEASURING LIGHTNING-INDUCED VOLTAGES ON AIRCRAFT ELECTRICAL CIRCUITS Final Report
L. C. Walko Washington NASA Feb. 1974 78 p refs
(Contract NAS3-14836)
(NASA-CR-2348; SRD-72-065) Avail: NTIS HC $3.75 CSCL

01C

The development of a test technique used for the measurement of lightning-induced voltages in the electrical circuits of a complete aircraft is described. The resultant technique utilizes a portable device known as a transient analyzer capable of generating unidirectional current impulses similar to lightning current surges, but at a lower current level. A linear relationship between the magnitude of lightning current and the magnitude of induced voltage permitted the scaling up of measured induced values to full threat levels. The test technique was found to be practical when used on a complete aircraft. Author

N74-16717*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

A SIMPLIFIED FLIGHT-TEST METHOD FOR DETERMINING AIRCRAFT TAKEOFF PERFORMANCE THAT INCLUDES EFFECTS OF PILOT TECHNIQUE

Terry J. Larson and William G. Schweikhard Washington Feb. 1974 41 p refs

(NASA-TN-D-7603; H-802) Avail. NTIS, HC $3.00 CSCL 01C

A method for evaluating aircraft takeoff performance from brake release to air-phase height that requires fewer tests than conventionally required is evaluated with data for the XB-70 airplane. The method defines the effects of pilot technique on takeoff performance quantitatively, including the decrease in acceleration from drag due to lift. For a given takeoff weight and throttle setting, a single takeoff provides enough data to establish a standardizing relationship for the distance from brake release to any point where velocity is appropriate to rotation. The lower rotation rates penalized takeoff performance in terms of ground roll distance; the lowest observed rotation rate required a ground roll distance that was 19 percent longer than the highest. Rotations at the minimum rate also resulted in lift-off velocities that were approximately 5 knots lower than the highest rotation rate at any given lift-off distance. Author

N74-16718*# McDonnell-Douglas Corp., Long Beach, Calif.

STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT-HAUL TRANSPORTATION. VOLUME 1: SUMMARY Final Report

Washington NASA Feb. 1974 157 p

(Contract NAS2-6994)

(NASA-CR-2353) Avail: NTIS HC $5.00 CSCL 01C

Conceptual designs of Quiet Turbofan STOL Short-Haul Transport Aircraft for the mid-1980 time period are developed and analyzed to determine their technical, operational, and economic feasibility. A matrix of aircraft using various high-lift systems and design parameters are considered. Variations in aircraft characteristics, airport geometry and location, and operational techniques are analyzed systematically to determine their effects on the market, operating economics, and community acceptance. The total systems approach is considered to be critically important in analyzing the potential of STOL aircraft to reduce noise pollution and alleviate the increasing air corridor and airport congestion. Author

N74-16719*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

CALCULATION OF THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF STOL AIRCRAFT WITH EXTERNALLY-BLOWN JET-AUGMENTED FLAPS Final Report

Marnix F. E. Dillenius, Michael R. Mendenhall, and S. B. Spangler Washington NASA Feb. 1974 197 p refs

(Contract NAS2-5247)

(NASA-CR-2358) Avail: NTIS HC $5.50 CSCL 01C

A theoretical investigation was made to develop methods for predicting the longitudinal aerodynamic characteristics of externally-blown, jet-augmented wing-flap combinations. A potential flow analysis was used to develop two models: a wing-flap lifting surface model and a high-bypass-ratio turbofan engine wake model. Use of these two models in sequence provides for calculation of the wing-flap load distribution including the influence of the engine wake. The method can accommodate multiple engines per wing panel and part-span flaps but is limited to the case where the flow and geometry of the configuration are symmetric about a vertical plane containing the wing root chord. Comparisons of predicted and measured lift and pitching moment on unswept and swept wings with one and two engines per panel and with various flap deflection angles indicate satisfactory prediction of lift and moment for flap deflections up to 30 to 40 degrees. At higher flap angles with and without power, the method begins to overpredict lift, due probably to the appearance of flow separation on the flaps. Author

N74-16720*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COMPUTER PROGRAMS FOR ESTIMATING AIRCRAFT TAKEOFF AND LANDING PERFORMANCE

Jeff V. Bowles and Thomas L. Galloway Jul. 1973 84 p refs

(NASA-TM-X-62333) Avail: NTIS HC $7.25 CSCL 01C

A set of computer programs has been developed to estimate the takeoff and landing maneuver of a given aircraft. The program is applicable to conventional, vectored lift and powered-lift concept aircraft. Portions of the program may also be used to evaluate the static performance of these types of aircraft. The aircraft is treated as a point mass confined to motion in a vertical plane, and rotational dynamics have been neglected. The required input is described and a sample case is presented. Author

N74-16721*# Lockheed-California Co., Burbank. Rotary Wing Div.

EXPERIMENTAL HINGELESS ROTOR CHARACTERISTICS AT LOW ADVANCE RATIO WITH THRUST

R. J. London, G. A. Watts, and G. J. Sissingh Dec. 1973 210 p refs Sponsored in part by Army Air Mobility Research and Development Lab., Ames Directorate

(Contract NAS2-7245)

(NASA-CR-114684) Avail: NTIS HC $13.50 CSCL 01C

An experimental investigation to determine the dynamic characteristics of a hingeless rotor operating at moderate to high lift was conducted on a small scale, 7.5-foot diameter, four-bladed hingeless rotor model in a 7 x 10-foot wind tunnel. The primary objective of this research program was the empirical determination of the rotor steady-state and frequency responses to swashplate and body excitations. Collective pitch was set from 0 to 20 degrees, with the setting at a particular advance ratio limited by the cyclic pitch available for hub moment trim. Advance ratio varied from 0.00 to 0.36 for blades with nondimensional first-flap frequencies at 1j15, 1.28 and 1.33 times the rotor rotation frequency. Several conditions were run with the rotor operating in the transition regime. Rotor response at high lift is shown to be generally nonlinear in this region. As a secondary objective an experimental investigation of the rotor response to 4/revolution swashplate excitations at advance ratios of 0.2 to 0.85 and at a nondimensional, first-flap modal frequency of 1.34 was also conducted, using the 7 x 10-foot wind tunnel. It is shown that 4/revolution swashplate inputs are a method for substantially reducing rotor-induced, shafttransmitted vibratory forces. Author

N74-16722# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.

AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, SUPPLEMENTAL ISSUE, 1972 ACCIDENTS

3 Dec. 1973 106 p

(NTSB-BA-73-10) Avail: NTIS HC $8.50

Reports of aircraft accidents and incidents that occurred in 1972 and have not been included in a prior issue of briefs are presented. Included are eight U. S. Air Carrier Accidents, 47 U. S. Air Carrier incidents, 17 U. S. General Aviation accidents, and 50 U. S. General Aviation incidents. Three Foreign Air Carrier accidents, one Foreign Air Carrier accident which occurred outside the U. S., and 19 Foreign General Aviation accidents that were investigated by the National Transportation Safety Board are also included. This publication is the final issue of Briefs of Accidents that occurred in calendar year 1972. Author

N74-16723*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYTICAL STUDY OF THE PERFORMANCE OF A GUST ALLEVIATION SYSTEM WITH A VANE SENSOR

Waldo I. Oehman Washington Feb. 1974 31 p refs

(NASA-TN-D-7431; L-9068) Avail: NTIS CSCL 01C

A 5670-kg airplane is assumed to be cruising with an airspeed of 109 m/sec at 3048-m altitude. It is also assumed that the

airplane is flying in turbulent air characterized by a Von Karman power spectral density function. Analysis has shown that a vane-controlled gust alleviation system (system I) in the airplane can reduce the normal acceleration at the airplane center of gravity by about 76 percent. The response to gusts of an angle-of-attack vane (the vane is located ahead of the wing) is fed simultaneously to the flap and elevator servos to provide alleviation. The signal to the servos is filtered so that required flap deflection rates are not too large. Also, another system (system II) uses a filter at the elevator servo to compensate for the time lead between vane response and elevator movement. This alleviation system has been effective in increasing the alleviation by 2.5 precent and 5 percent at stations 1 and 2 mean aerodynamic chords behind the airplane center of gravity, respectively, as compared to system I. The vane-controlled alleviation systems of the present study give better alleviation than did the accelerometer-controlled alleviation system of a previous study. However, the comparison is valid only for the assumptions made in both studies. Other factors should be condsidered in future work so that better judgment of both types of system can be made. Author

N74-16724*# Scientific Translation Service, Santa Barbara, Calif.

APPLICATION OF THE METHOD OF INTEGRATING MATRICES FOR CALCULATING THE NATURAL OSCILLATIONS OF A PROPELLER BLADE WITH CONSIDERATION OF DEFLECTION IN TWO PLANES AND TWISTING

A. Yu. Liss and G. U. Margulis Washington NASA Feb. 1974 17 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekhn. (Kazan), v. 16, no. 1, 1973 p 30-37 (Contract NASw-2483)

(NASA-TT-F-15365) Avail: NTIS HC $4.00 CSCL 01B

A numerical method for determining the natural oscillations of a propeller blade is presented. The effects of twisting and deflection in two planes are considered. Methods which are suitable for programming, for calculating the elements of the integrating matrices, both for continuous as well as for discontinuous integrand functions, and also for the case when spacing at different portions of the integration interval are not the same, are developed. Author

N74-16725*# Sandia Labs., Albuquerque, N.Mex. Particulate Dynamics Div.

SONIC BOOM MEASUREMENTS FROM ACCELERATING SUPERSONIC TRACKED SLEDS

Jack W. Reed Jan. 1974 107 p refs

(NASA Order L-75054; Contract AT(29-1)-789)

(NASA-CR-132388; SLA-73-714) Avail: NTIS HC $8.50 CSCL 20D

Supersonic sled tests on the Sandia 1524-m (5000-ft) track generate sonic booms of sufficient intensity to allow some airblast measurements at distance scales not obtained from wind tunnel or flight tests. During acceleration, an emitted curved boom wave propagates to a caustic, or focus. Detailed measurements around these caustics may help to clarify the overpressure magnification which can occur from real aircraft operations. Six fixed pressure gages have been operated to document the general noise field, and a mobile array of twelve gages. Author

N74-16726*# Boeing Commercial Airplane Co., Seattle, Wash.

THE RESULTS OF A HIGH-SPEED WIND TUNNEL TEST TO INVESTIGATE THE EFFECTS OF THE NASA REFAN JT8D ENGINE NACELLES ON THE STABILITY AND CONTROL CHARACTERISTICS OF THE BOEING 727 AIRPLANE

E. A. Kupcis Dec. 1973 52 p ref

(Contract NAS3-17842)

(NASA-CR-134545; D6-41499) Avail: NTIS HC $5.75 CSCL 01B

A high speed wind tunnel test was conducted to investigate the effects of the NASA Refan JT8D engine nacelles on the stability and control characteristics of the Boeing 727 airplane. The test was performed at the Calspan Corporation 8x8 ft. (2.44x2.44 m.) transonic wind tunnel. Both the 727-200 and -100 models were tested. A small nose-down pitching moment increment and a slight increase in longitudinal stability were noted due to the Refan nacelles. The directional stability of the 727-200 airplane increased up to 10 percent. A smaller improvement was observed on the 727-100 model. In general, the high speed stability and control characteristics of the basic airplane are not significantly altered by the Refan nacelle installation. Author

N74-16727# National Transportation Safety Board, Washington, D.C.

SPECIAL STUDY REPORT ON APPROACH AND LANDING ACCIDENT PREVENTION FORUM

19 Sep. 1973 116 p refs Conf. held at Washington, D.C., 24-25 Oct. 1972

(NTSB-AAS-73-2) Avail: NTIS HC $9.00

An accident prevention study is presented which analyzes the papers, recommendations, and views presented by aviation community participants at the National Transportation Safety Board Approach and Landing Accident Prevention Forum. This part of the report presents: (1) the Safety Board's conclusions and recommendations relative to the prevention of approach and landing accidents, (2) a glossary of terms, and (3) a summary of previous recommendation by the Safety Board as a result of approach and landing accidents. Author

N74-16728*# Graham Associates, Shaw Island, Wash.

THEORETICAL STUDY OF THE EFFECTS OF REFRACTION ON THE NOISE PRODUCED BY TURBULENCE IN JETS Final Report

E. W. Graham and B. B. Graham Washington NASA Mar. 1974 104 p refs

(Contract NAS1-11533)

(NASA-CR-2390) Avail: NTIS HC $4.50 CSCL 20A

The production of noise by turbulence in jets is an extremely complex problem. One aspect of that problem, the transmission of acoustic disturbances from the interior of the jet through the mean velocity profile and into the far field is studied. The jet (two-dimensional or circular cylindrical) is assumed infinitely long with mean velocity profile independent of streamwise location. The noise generator is a sequence of transient sources drifting with the surrounding fluid and confined to a short length of the jet. Author

N74-16729*# Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept.

ADVANCED SUBSONIC LONG-HAUL TRANSPORT TERMINAL AREA COMPATIBILITY STUDY. VOLUME 1: COMPATIBILITY ASSESSMENT

Feb. 1974 186 p refs

(Contract NAS1-12018)

(NASA-CR-132367; O6-22561-Vol-1) Avail: NTIS HC $12.50 CSCL 01C

An analysis was made to identify airplane research and technology necessary to ensure advanced transport aircraft the capability of accommodating forecast traffic without adverse impact on airport communities. Projections were made of the delay, noise, and emissions impact of future aircraft fleets on typical large urban airport. Design requirements, based on these projections, were developed for an advanced technology, long-haul, subsonic transport. A baseline aircraft was modified to fulfill the design requirements for terminal area compatibility. Technical and economic comparisons were made between these and other aircraft configured to support the study. Author

N74-16730*# Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept.

ADVANCED SUBSONIC LONG-HAUL TRANSPORT TERMINAL AREA COMPATIBILITY STUDY. VOLUME 2: RESEARCH AND TECHNOLOGY RECOMMENDATIONS

Feb. 1974 159 p refs

(Contract NAS1-12018)

(NASA-CR-132368; D6-22562-Vol-2) Avail: NTIS HC $11.00 CSCL 01C

The Terminal Area Compatibility (TAC) study is briefly summarized for background information. The most important research items for the areas of noise congestion, and emissions are identified. Other key research areas are also discussed. The 50 recommended research items are categorized by flight phase, technology, and compatibility benefits. The relationship of the TAC recommendations to the previous ATT recommendations is

discussed. The bulk of the document contains the 50 recommended research items. For each item, the potential payoff, state of readiness, recommended action and estimated cost and schedule are given. Author

N74-16731# Institut de Mecanique des Fluides de Marseille (France).
STUDY OF DETACHMENT ON THE REAR BLADE OF A HELICOPTER ROTOR Final Report [ETUDE DU DECROCHAGE SUR LA PALE RECULANTE D'UN ROTOR D'HELICOPTERE]
C. Maresca, J. Rebont, and N. Pellerin Nov. 1973 91 p refs In FRENCH
(E-172) Avail: NTIS HC $7.75

An experimental investigation was made of flow detachment on the rear blade helicopter rotors and its effects on helicopter performance. The development and structure of the three dimensional boundary layer is discussed along with pressure measurements and coefficients of friction. Transl. by E.H.W.

N74-16732# Centre d'Essai Aeronautique, Toulouse (France).
ENDURANCE TESTS ON TRANSPORT AIRCRAFT COCKPIT WINDOW GLASSES [ESSAIS D'ENDURANCE SUR GLACES D'AVION DE TRANSPORT]
1973 12 p In FRENCH Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.00

Results of endurance tests on cockpit window glazing for the European Airbus are reported. The objective of these tests was to demonstrate that if this glazing were exposed to varying environmental conditions during large number of flights, no rupture, delamination or leak would occur, and transparency would remain at an acceptable level. The test parameters are defined, and simplifications are introduced for simulation. The test installation is comprised of a wind tunnel with refrigerator, and two caissons. ESRO

N74-16733# Aerospatiale Usines de Toulouse (France).
USE OF SIMULATION FOR THE DEVELOPMENT OF CONCORDE [UTILISATION DE LA SIMULATION DANS LE DEVELOPPEMENT DE CONCORDE]
R. Deque and J. Tardy 5 Aug. 1973 10 p In FRENCH Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.00

The flight simulator for the Concorde aircraft development is described. Several means of simulation have been used, analog as well as hybrid. 9,500 hours of simulation have been accomplished up to now with the simulator, 3,500 of which were completed before the first flight of the 001 prototype. The tests and corresponding investigations are in 5 categories, which are successively examined: perfectioning of the aircraft and its systems, test flight preparation and crew training, crew workload, operational studies together with Eurocontrol, and preparation for the certification of the aircraft. ESRO

N74-16734# Royal Aircraft Establishment, Farnborough (England).
IN SITU NON-DESTRUCTIVE TESTING OF AIRCRAFT STRUCTURES BY HOLOGRAPHIC INTERFEROMETRY
M. P. Wright Feb. 1973 13 p refs
(RAE-TR-72218; BR33628) Avail: NTIS HC $4.00

An investigation into a method of non-destructively testing part of an aircraft in situ is described. The method used was double-exposure holographic interferometry whereby two holograms of an object are recorded on the same holographic plate, the only difference being that the object is strained between exposures. The holograms were taken with a pulsed ruby laser and the strain applied by gentle heating. Results indicate that the technique could be successfully applied, for example, to a complete aircraft in a hangar. ESRO

N74-16735# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.
AN EVALUATION OF THE MISSION ANALYSIS CONCEPT FOR THE DEFINITION OF GUST DESIGN LOADS
J. B. DeJonge 10 Oct. 1972 57 p refs Sponsored by the Neth. Agency for Aerospace Programs
(NLR-TR-72131-U) Avail: NTIS HC $6.00

The Mission Analysis concept for defining design loads was assessed and compared with the current design procedure based on Design Envelope concepts. Although the Mission Analysis concept permits design loads of equal probability of exceedance to be obtained for all components, this does not imply that a fixed failure probability for the aircraft as a whole can be obtained. It is argued that a rigorous application of the concept is unfeasible in practice. The suitability of a Mission Analysis in conjuction with Design Envelope procedures is described. Author (ESRO)

N74-16736# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
DESIGN FOR MAINTAINABILITY. AN INTRICATE SIMPLICITY
J. Heyligers [1973] 45 p Presented at the Danish Assoc. of Aeron. Engineers Maintenance Symp., Copenhagen, 7 Nov. 1973
Avail: NTIS HC $5.25

Aircraft maintenance, when analyzed from an operator's point of view, will yield basic maintainability requirements which can be translated into general guidelines for design. The simple picture is greatly complicated when specific conclusions are to be drawn for all areas of airframe and system design and when, in the various phases of a project, the realization of maintainability is actually to be pursued and controlled. Some aspects of this process, which also involves endurance and reliability, are dealt with in more detail and illustrated by examples from the actual practice of aircraft design and operation. Author (ESRO)

N74-16737# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
COLUMN FAILURE OF THIN-WALLED COMPRESSION MEMBERS IN AIRCRAFT WINGS AS AFFECTED BY WALL IMPERFECTION AND CRUSHING
A. VanDerNeut Jun. 1973 22 p refs
(VTH-175) Avail: NTIS HC $4.25

The stiffness reduction of the composing walls of thin-walled compression members, due to initial waviness of the walls, affects the bending stiffness and consequently the buckling load in column failure. When loaded in bending, thin aircraft wings, and consequently the compression members of the wing panels attain noticeable curvature. The bending moment in these members is maximal in the center of the bays between successive ribs and minimal at the supporting ribs (crushing). Therefore, their bending stiffness varies along the bay and differs from the bending stiffness in the absence of crushing. For a representative model the buckling load is established as affected by the crushing parameter. Strength reduction due to crushing is compared to reduction due to wall imperfection alone. Author (ESRO)

N74-16738# Texas A&M Univ., College Station. Engineering Experiment Station.
RESEARCH ON AIRCRAFT DYNAMICS FOR SUBSONIC FLIGHT Final Report, 1 Jun. 1971 - 31 Aug. 1973
William P. Jones 28 Sep. 1973 8 p refs
(Grant DA-ARO(D)-31-124-71-G153)
(AD-770540; TEES-2809-73-01) Avail: NTIS CSCL 01/3

The report on helicopter dynamics is submitted as a collection of abstracts of papers published or to be published. The principal authors of the papers listed are J. Bicknell, W. P. Jones, and A. G. Parker. GRA

N74-16739# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF PRESSURE ON AN OSCILLATING AILERON IN TRANSONIC FLOW
V. V. Mazarenko and T. P. Nevezhina 29 Oct. 1973 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 2, 1972 p 179-185
(AD-769982; FTD-HT-23-209-74) Avail: NTIS CSCL 01/3

The report gives the results of pressure measurements on an oscillating aileron in plane-parallel transonic flow. The measurements were made using pressure sensors inside the model in a regime of forced oscillations at Mach - 0.974. GRA

N74-16740# Kaman Aerospace Corp., Bloomfield, Conn.
MAINTAINABILITY ANALYSIS OF MAJOR HELICOPTER

COMPONENTS Final Report
Thomas N. Cook, Robert L. Young, and Frank E. Starses Aug. 1973 316 p
(Contract DAAJ02-72-C-0065; DA Proj. 1F1-62205-A-119)
(AD-769941; USAAMRDL-TR-73-43) Avail: NTIS CSCL 01/3

The report examines the factors responsible for the high man-hour cost of maintaining current-inventory Army helicopters. Major components of six helicopter models were analyzed to identify the significant man-hour consumers on each aircraft. Causes for maintenance were established in terms of failure modes, maintenance frequency, and average repair time. Major component replacement tasks were structured in terms of specific time elements, and important factors affecting maintenance task performance were established. The report documents the results of three study tasks. Using data derived from the analysis, a checklist has been developed for use in maintainability analyses of future helicopter designs. (Modified author abstract) GRA

N74-16741# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
DESIGN AND FABRICATION OF A BORON/ALUMINUM COMPOSITE WING BOX TEST SPECIMEN Final Report, Mar. 1972 - May 1973
William F. Wennhold Jul. 1973 147 p refs
(Contract N62269-72-C-0414)
(AD-770203; CASD-NSC-73-005) Avail: NTIS CSCL 01/3

The report summarizes the design, analysis, fabrication and testing of a wing box specimen using boron aluminum as the primary structural material. The primary purpose of the program was to demonstrate the feasibility of using boron-aluminum in a major aircraft structural component. The wing section selected is typical of many aircraft wing structures and simulated an integral wing fuel tank section capable of withstanding internal pressure in addition to the basic bending and torsion loads. (Modified author abstract) GRA

N74-16742# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DROP AND STATIC TESTS ON A TENTH-SCALE MODEL OF AN AIR CUSHION LANDING SYSTEM (ACLS) M.S. Thesis
Anthony Rodrigues Sep. 1973 161 p refs
(AF Proj. 1369)
(AD-770026; GA/ME/73-3) Avail: NTIS CSCL 01/3

An experimental investigation of the performance of an Air Cushion Landing System (ACLS) on a one-tenth scale model of a CC-115 Canadian aircraft is discussed. Several different types of tests were conducted on an extended version of the ACLS trunk at simulated fullscale trunk pressures of 315 psfg, out of ground effect, and 342 psfg, in ground effect. Cushion pressure was 160 psfg, in ground effect, during hover. The experiments involved: vertical drop tests to measure the effects of sink rate and initial attitude between full-sclae sink rates of 3.0 and 12.5 fps, and attitudes of pitch and roll from 0.0 to 12.0 and 0.0 to 7.5 degrees, respectively; static equilibrium tests to measure vertical stiffness, roll stiffness, pitch stiffness, and floor pressure exerted by the ACLS with loads up to 4.1 times the aircraft landing weight; and braking tests to obtain the effects of changing brake pillow thickness between simulated full-scale heights of 0.0 inches and 26.0 inches. (Modified author abstract) GRA

N74-16743# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HIGH ACCELERATION COCKPIT: THE MANEUVERING COUNTERMEASURE
Philip V. Kulwicki, John P. Lyons, and Richard L. Ravenelle Sep. 1973 18 p Presented at the AFSC Sci. and Eng. Symp., Kirtland AFB, Ohio, 2-4 Oct. 1973
(AF Proj. 7184)
(AD-770287; AMRL-TR-73-93) Avail: NTIS CSCL 01/3

The high acceleration cockpit represents an innovative approach to cockpit design which provides a unique blend of pilot capabilities and airplane performance potential, especially for the counter air mission. By altering the standard cockpit geometry, positive airplane control and tactical decisions are enabled during levels of maneuvering acceleration well above 7G. The result, in the context of emerging fighter capability, is a dramatic increase in combat effectiveness and operational advantage. Author (GRA)

N74-16744# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
STUDY OF REVERSE-FLOW CHARACTERISTICS OF A TIP FAN AND AN EJECTOR M.S. Thesis
Ernest Kunstadt Oct. 1973 69 p refs
(AD-770080; GAM/ME/73A-1; AFFDL-TR-73-73) Avail: NTIS CSCL 21/5

An investigation was carried out in order to determine the reverse-flow characteristics of an ejector and a tip-turbine fan. The components tested a model TD-530 ejector and model TD-457 tip-turbine fan manufactured by Tech Development Corporation of Dayton, Ohio. A plenum chamber and air flow system were designed and constructed to permit variation of flow rates and back pressures, as well as fan and ejector driving pressures. Measurements of pressures and temperatures were taken in order to determine air mass flow rates of drive and inlet air as a function of back pressure. Fan speed for the tip-turbine fan was also monitored as a function of back pressure, and various ejector exit conditions were studied to determine their affect on basic ejector performance. The secondary air mass flow rates for both devices were found to be practically linear functions of back pressure, up to and including the reverse-flow regime. The results of these studies are presented in graphical form and discussed. Author (GRA)

N74-16745# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), AH-1G- DRIVE LINK, SWASHPLATE Interim Report, 1 Jan. 1964 - 30 Jun. 1972
Nov. 1973 23 p
(AD-770499; USAAVSCOM-TR-73-28) Avail: NTIS CSCL 01/3

The report is designed to illustrate cost savings which would result from specific efforts in the areas of product improvement in quality and design. For the purpose of this study the cost savings produced in the area of product improvement are based on total elimination of a certain failure mode or modes. Appropriate modes are chosen because of their proportion of the total removals or their proportion in combination with other similar modes. GRA

N74-16746# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS) AH-1G DRIVESHAFT ASSY, MAIN TRANSMISSION TO ENGINE Interim Report, 1 Jan. 1964 - 30 Jun. 1972
Nov. 1973 23 p refs
(AD-770498; USAAVSCOM-TR-73-27) Avail: NTIS CSCL 01/3

The report is designed to illustrate cost savings which would result from specific efforts in the areas of product improvement in quality and design. For the purpose of this study the cost savings produced in the area of product improvement are based on total elimination of a certain failure mode or modes. GRA

N74-16747# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECT OF MODIFIED SEAT ANGLE ON AIR TO AIR WEAPON SYSTEM PERFORMANCE UNDER HIGH ACCELERATION Final Report
D. B. Rogers, A. B. Ashare, K. A. Smiles, J. W. Frazier, and V. D. Skowronski Jul. 1973 19 p
(AF Proj. 7222)
(AD-770271; AMRL-TR-73-5) Avail: NTIS CSCL 01/3

In air to air combat, the weapons system that has the highest agility and G maneuvering capability has a decided advantage over a less capable system. A method of increasing the G tolerance of the human portion of the system is the use of reclining seats. The modified closed loop Dynamic Environment Simulator system was employed as the experimental test bed for investigation of centrifuge pilots in the reclined position. The centrifuge pilots were required to fly through a series of G on G combat maneuvers and to perform target lock-on and boresight cannon firing through a predictive gunsight reticle at a projected enemy aircraft. The performance scoring was

measured as number of ballistic rounds delivered on the target. (Modified author abstract) GRA

N74-16748# Defense Documentation Center, Alexandria, Va.
ENVIRONMENTAL POLLUTION: NOISE POLLUTION - SONIC BOOM Report Bibliography, Apr. 1959 - Feb. 1973
Nov. 1973 176 p refs Supersedes AD-722910
(AD-769970; AD-722910; DDC-TAS-73-74) Avail: NTIS CSCL 20/1

The references in the bibliography cover a wide range of the parameter of sonic boom and noise pollution, as well as damages caused by it. Corporate Author/Monitoring Agency, Subject, and Personal Author Indexes are included.
Author (GRA)

N74-16749# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
AIRCRAFT ANTISKID ANALYSIS VERIFICATION AND REFINEMENT Final Report, Dec. 1970 - Apr. 1973
Byron H. Anderson Sep. 1973 365 p refs
(Contract F33615-71-C-1109; AF Proj. 1369)
(AD-770300; AFFDL-TR-73-70) Avail: NTIS CSCL 01/3

A program for verifying and refining a previously developed aircraft antiskid performance and system compatibility analysis procedure is described. Analysis verification was performed by comparing antiskid system operation as predicted by the analytical procedures with that recorded during laboratory testing. The laboratory tests were conducted at the Air Force Flight Dynamics Laboratory Landing Gear Test Facility at Wright-Patterson Air Force Base, Ohio using a set-up consisting of F-111 aircraft main landing gear, tire, wheel, brake, hydraulic brake actuation system and several antiskid control circuit variations. (Modified author abstract) GRA

N74-16750# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL STUDY OF ATTENUATION OF SHOCK WAVES IN AIRCRAFT FUEL TANKS M.S. Thesis
John R. Breuninger, Jr. Jun. 1973 73 p refs
(AD-769930; GA/MC/73-3) Avail: NTIS CSCL 01/3

When a full, or partially full, aircraft fuel tank is penetrated by a high velocity projectile, a phenomenon known as hydraulic ram effect, created by the passage of a projectile through the fluid often causes massive damage to the tank. This study was conducted to continue experimental investigation of the attenuation of the hydraulic ram effect through addition of a gas to a fuel-foam mixture. The tests were conducted using two types of projectile (1/2 in. steel spheres and 0.50 caliber ogival projectiles) which were fired into a test tank. The tank was filled first with water and then a water/Pneumacel mixture. Four pressure transducers were located in the back wall of the tank and two pressure transducers were located inside the tank to measure the pressure pulses. (Modified author abstract) GRA

N74-16751# Rockwell International Corp., Los Angeles Calif. Aircraft Div.
STOL TACTICAL AIRCRAFT INVESTIGATION, EXTERNALLY BLOWN FLAP. VOLUME 2: DESIGN COMPENDIUM Final Report, 10 Jun. 1971 - 10 Dec. 1972
Marshall H. Roe, Dirk J. Renselaer, and Ralph A. Quam Apr. 1973 177 p refs 6 Vol.
(Contract F33615-71-C-1760; AF Proj. 643A)
(AD-770110; NA-72-868-Vol-2; AFFDL-TR-73-20-Vol-2) Avail: NTIS CSCL 01/1

The basic objective of the work reported herein was to provide a broader technology base to support the development of a medium STOL Transport (MST) airplane. This work was limited to the application of the externally blown flap (EBF) powered lift concept. The technology of EBF STOL aircraft has been investigated through analytical studies, wind tunnel testing, flight simulator testing, and design trade studies. The results obtained include development of methods for the estimation of the aerodynamic characteristics of an EBF configuration, STOL performance estimation methods, safety margins for takeoff and landing, wind tunnel investigation of the effects of varying EBF system geometry parameters, configuration definition to meet MST requirements, trade data on performance and configuration requirement variations, flight control system mechanization trade data, handling qualities characteristics; piloting procedures, and effects of applying an air cushion landing system to the MST. (Modified author abstract) GRA

N74-16752# Rockwell International Corp., Los Angeles Calif. Aircraft Div.
STOL TACTICAL AIRCRAFT INVESTIGATION-EXTERNALLY BLOWN FLAP. VOLUME 5: FLIGHT CONTROL TECHNOLOGY. PART 2: SIMULATION STUDIES/FLIGHT CONTROL SYSTEM VALIDATION Final Report, 10 Jun. 1971 - 10 Dec. 1972
James E. Campbell, William K. Elsanker, and Victor H. Okumoto Apr. 1973 210 p refs 6 Vol.
(Contract F33615-71-C-1760; AF Proj. 643A)
(AD-770449; NA-72-868-Vol-5-Pt-2;
AFFDL-TR-73-20-Vol-5-Pt-2) Avail: NTIS CSCL 01/3

The basic objective of the work reported was to provide a broader technology base to support the development of a medium STOL Transport (MST) airplane. This work was limited to the application of the externally blown flap (EBF) powered lift concept. From an overall assessment of study results, it is concluded that the EBF concept provides a practical means of obtaining STOL performance for an MST with relatively low risk. (Modified author abstract) GRA

N74-16753# Rockwell International Corp., Los Angeles Calif. Aircraft Div.
STOL TACTICAL AIRCRAFT INVESTIGATION-EXTERNALLY BLOWN FLAP. VOLUME 6: AIR CUSHION LANDING SYSTEM TRADE STUDY Final Report, 10 Jun. 1971 - 10 Dec. 1972
Robert G. Gustavson Apr. 1973 94 p refs 6 Vol.
(Contract F33615-71-C-1760; AF Proj. 643A)
(AD-770448; NA-72-868-Vol-6; AFFDL-TR-73-20-Vol-6) Avail: NTIS CSCL 01/3

The primary objective of this trade study is to directly install the air cushion landing system (ACLS) as developed by the Flight Dynamics lab, in the MST configuration and compare it with a conventional landing gear. The initial ACLS design was for as large a cushion area as practical. Direct performance comparisons with conventional gear at the same CBR or field rating proved to be difficult with this size cushion. It was decided to try a second ACLS design with four times the cushion pressure of the initial concept. These concepts are called low- and high-pressure ACLS designs, respectively. GRA

N74-16754# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
AN INVESTIGATION OF AIRBORNE DISPLAYS AND CONTROLS FOR SEARCH AND RESCUE (SAR). VOLUME 9: PROJECT SEA SCANNER AVIONICS AND SENSOR SYSTEM Final Report, Oct. 1972 - Jul. 1973
R. J. Kirk, F. S. Malver, and W. F. Helmbrecht Jul. 1973 108 p refs 9 Vol.
(Contract N00014-69-C-0460; NR Proj. 213-072)
(AD-770548; Rept-12609-FRI-Vol-9; JANAIR-73-1002) Avail: NTIS CSCL 06/7

A study was conducted to define and select an avionics and sensor system for a U. S. Coast Guard multimission fixed-wing twin-jet aircraft. The system requirements were compiled from previous concept definition studies done under this contract for a search and rescue helicopter and from analysis of mission scenarios fitted to the unique USCG missions. Study tasks included definition of the avionics and sensor requirements to meet mission goals consistent with constraints of a preselected baseline aircraft. A full complement of equipment was recommended along with interface drawings and installation layouts. A system performance specification and subsystem procurement specifications were developed. Author (GRA)

N74-16755# Ministry of Defence, London (England).
REPORT ON THE CONFERENCE ON TRANSPARENT AIRCRAFT ENCLOSURES
N. S. Corney Jun. 1973 57 p Conf. held at Las Vegas, Nev., 5-8 Feb. 1973
(AD-769372; D-Mat-195; BR36095) Avail: NTIS CSCL 01/3

The report describes papers presented at a conference which was the most recent of a series which has been held over a

period of many years sponsored in the main by the U.S. Air Force Materials Laboratory. All aspects of transparencies for fixed wing aircraft and helicopters were covered including rather remote topics such as bird habits and migration studied in connection with the hazard of bird impact on transparencies. From the materials aspect, the most interesting papers were those dealing with experience in the handling and application of polycarbonate as a glazing material. Several papers dealt with the experience gained in service with helicopter transparencies; the accumulation of scratches from general use and from wiper action constitute the most serious deficiency in performance. The need for good hard coatings for plastics materials was emphasized throughout the conference. The design of transparencies to withstand bird impact was the subject of one complete session. Use of laminated polycarbonate with or without glass facing plies constitutes an assembly which will resist four lb birds, but for high reliability such as is needed on civil aircraft the use of all glass panels is common; the introduction of high strength glass enables designs to approach the low overall weight of plastics for the same impact resistance. (Modified author abstract) GRA

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-16756*# Linguistic Systems, Inc., Cambridge, Mass.
EXPLOITATION OF WIND ENERGY
Hans Christaller Washington NASA Feb. 1974 12 p refs Transl. into ENGLISH from Elektrizitaetswirtschaft (West Germany), v. 50, no. 11, Nov. 1951 p 320-322
(Contract NASw-2482)
(NASA-TT-F-15309) Avail: NTIS HC $3.00 CSCL 10B

The utilization of wind power is discussed. A measurement is made of the energy available from air currents. Wind turbulence is calculated together with the average power. The structural features of windmills are discussed in relation to possible industrial applications. Author

N74-16757*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WIND ENERGY CONVERSION SYSTEMS
Jospeh M. Savino, ed. Dec. 1973 270 p refs Workshop Proc. held at Washington, D. C., 11-13 Jun. 1973
(Grant NSF AG-465)
(NASA-TM-X-69786; NSF/RA/W-73-006) Avail: NTIS HC $15.50 CSCL 10B

Economic feasibilities and energy conversion efficiencies are considered for various alternative energy sources that utilize wind forces. For individual titles, see N74-16758 through N74-16799.

N74-16758* Allis-Chalmers Mfg. Co., York, Pa.
SMITH-PUTNAM WIND TURBINE EXPERIMENT
Beauchamp E. Smith *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 5-7 (For availability see N74-16757 08-03)
CSCL 10B

A brief outline of the many problems encountered during testing of a wind turbine generator prototype unit is given. Its feasibility was demonstrated by the generation of electricity in commercial quantities with delivery to a utility transmission network. The experiment was terminated after blade failure occurred. G.G.

N74-16759* Allis-Chalmers Mfg. Co., York, Pa.
MOTION PICTURE HISTORY OF THE ERECTION AND OPERATION OF THE SMITH-PUTNAM WIND GENERATOR
Carl Wilcox *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 8-10 (For availability see N74-16757 08-03)
CSCL 10B

A color movie presentation is discussed that presents the various stages in assembling the major subsystems of a synchronous wind generator, such as installing the rotor blades and the rotating platform at the top of the tower. In addition scenes are shown of the wind generator in operation. Author

N74-16760* Federal Power Commission, Washington, D.C.
PERCY THOMAS WIND GENERATOR DESIGNS
Charles W. Lines *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 11-18 (For availability see N74-16757 08-03)
CSCL 10B

The technical and economic feasibilities of constructing a windpowered generator with a capacity of 2,000 to 4,000 kilowatt are considered. Possible benefits of an integrated wind generating electric energy source in an electric utility network are elaborated. Applications of a windpowered waterpump, including its use as a pumping source for hydroelectric pump storage operations, are also mentioned. It is concluded that the greatest potential of the wind generator is to generate heat directly and not conversion to electricity and then to heat. G.G.

N74-16761* Stuttgart Univ. (West Germany).
PAST DEVELOPMENTS OF LARGE WIND GENERATORS IN EUROPE
Ulrich Hutter *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 19-22 (For availability see N74-16757 08-03)
CSCL 10B

Physical size, maximum power output, and other characteristics of various windpower systems are shown in picture form. G.G.

N74-16762* Tompkin (Joseph), Salem, Ore.
INTRODUCTION TO VOIGT'S WIND POWER PLANT
Joseph Tompkin *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 23-26 (For availability see N74-16757 08-03)
CSCL 10B

The design and operation of a 100 kilowatt wind driven generator are reported. Its high speed three-bladed turbine operates at a height of 50 meters. Blades are rigidly connected to the hub and turbine revolutions change linearly with wind velocity, maintaining a constant speed ratio of blade tip velocity to wind velocity over the full predetermined wind range. Three generators installed in the gondola generate either dc or ac current. Based on local wind conditions, the device has a maximum output of 720 kilowatts at a wind velocity of 16 meters per second. Total electrical capacity is 750 kilowatts, and power output per year is 2,135,000 kilowatt/hours. G.G.

N74-16763* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WHERE THERE IS A WIND, THERE IS A WAY
Charles A. Mosher *In its* Wind Energy Conversion Systems Dec. 1973 p 27-32 (For availability see N74-16757 08-03)
CSCL 10B

A shift in USA energy policy from oil or natural gases to thermonuclear fission and solar energy is predicted. A massive diversified energy research and development effort to productively harness the energy in the winds is outlined to develop commercially feasible wind energy conversion systems - considered a form of solar energy - in the near future. G.G.

N74-16764* West Texas State Univ., Canyon.
NEED FOR A REGIONAL WIND SURVEY
Vaughn Nelson and Earl Gilmore (Amarillo Coll.) *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 33-40 (For availability see N74-16757 08-03)
CSCL 10B

Accurate measurements for the purpose of estimating wind energies are proposed in those regions of the USA where the greatest potentials exists. Preliminary wind characteristic calculations from weather station data are provided for the Southern Great Plains region; wind energies from 153 to 212 kW-hr/(ft squared-per year) for 1970 to 1972 are determined. It is concluded that a wind energy survey based on data compiled from weather service stations is feasible for determining the

energy potential of a windpowered integrated energy network. G.G.

N74-16765* Oklahoma Univ., Norman.
WIND POWER DEMONSTRATION AND SITING PROBLEMS
Karl H. Bergey *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 41-45 refs (For availability see N74-16757 08-03)
CSCL 10B

Technical and economic feasibility studies on a small windmill to provide overnight charging for an electrically driven car are reported. The auxiliary generator provides power for heating and cooling the vehicle which runs for 25 miles on battery power alone, and for 50 miles with the onboard charger operating. The blades for this windmill have a diameter of 12 feet and are coupled through to a conventional automobile alternator so that they are able to completely recharge car batteries in 8 hours. Optimization of a windmill/storage system requires detailed wind velocity information which permits rational siting of wind power system stations. G.G.

N74-16766* Alaska Univ., Fairbanks.
SURFACE WIND CHARACTERISTICS OF SOME ALEUTIAN ISLANDS c20
Tunis Wentink, Jr. *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 46-52 refs (For availability see N74-16757 08-03)
CSCL 04B

The wind power potential of Alaska is assessed in order to determine promising windpower sites for construction of wind machines and for shipment of wind derived energy. Analyses of near surface wind data from promising Aleutian sites accessible by ocean transport indicate probable velocity regimes and also present deficiencies in available data. It is shown that winds for some degree of power generation are available 77 percent of the time in the Aleutians with peak velocities depending on location. G.G

N74-16767* Oregon State Univ., Corvallis.
WIND POWER RESEARCH AT OREGON STATE UNIVERSITY
E. Wendell Hewson *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 53-61 refs (For availability see N74-16757 08-03)
CSCL 10B

There have been two primary thrusts of the research effort to date, along with several supplementary ones. One primary area has been an investigation of the wind fields along coastal areas of the Pacific Northwest, not only at the shoreline but also for a number of miles inland and offshore as well. Estimates have been made of the influence of the wind turbulence as measured at coastal sites in modifying the predicted dependence of power generated on the cube of the wind speed. Wind flow patterns in the Columbia River valley have also been studied. The second primary thrust has been to substantially modify and improve an existing wind tunnel to permit the build up of a boundary layer in which various model studies will be conducted. One of the secondary studies involved estimating the cost of building an aerogenerator. Author

N74-16768* Electrical Research Association, Surrey (England).
WIND DATA FOR WIND DRIVEN PLANT c20
Arthur H. Stodhart *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 62-69 (For availability see N74-16757 08-03)
CSCL 04B

Simple, averaged wind velocity data provide information on energy availability, facilitate generator site selection and enable appropriate operating ranges to be established for windpowered plants. They also provide a basis for the prediction of extreme wind speeds. Author

N74-16769* Princeton Univ., N.J.
AN INTRODUCTION TO THE PRINCETON SAILWING WINDMILL
T. E. Sweeney and W. B. Nixon *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 70-72 refs (For availability see N74-16757 08-03)
CSCL 10B

Specifically discussed is the sailwing windmill. The aerodynamic characteristics of the sailwing itself are presented in condensed form and its natural application to the wind machine is discussed. Past and present sailwing windmill configurations are shown and their relative merits are compared. A section on a future promising configuration is presented and its compatibility to advanced technology electrical machinery is briefly discussed. Also included is a short bibliography. Author

N74-16770* Windworks, Inc., Mukwanago, Wis.
THE USE OF PAPER HONEYCOMB FOR PROTOTYPE BLADE CONSTRUCTION FOR SMALL TO MEDIUM-SIZED WIND DRIVEN GENERATORS c18
Hans Meyer *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 73-74 (For availability see N74-16757 08-03)
CSCL 11D

Paper honeycomb is used for the construction of conventional, propeller-type, windmill blades. Using fairly simple techniques and conventional power tools, it is possible to shape both simple foils and more complex foils with or without tapered plan forms and with or without varying profiles. A block of honeycomb, in its compressed form, is mounted on a wedge and run through a bandsaw with the table at an appropriate tilt angle. It is the combination of the wedge angle and the table angle that gives the tapered planform and profile shape. Next the honeycomb is expanded on the shaft and jigged to give the desired angles of attack. With the honeycomb fixed in position, the blade is covered with a fine weave fiberglass cloth. Any surface quality can then be achieved with filling and sanding. Author

N74-16771* New Alchemy Inst., Woods Hole, Mass.
THE SAIL WING WINDMILL AND ITS ADAPTATION FOR USE IN RURAL INDIA
Marcus M. Sherman *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 75-79 refs (For availability see N74-16757 08-03)
CSCL 10B

An 8 meter-diameter prototype sail wing windmill is reported that uses a one meter-diameter bullock cartwheel to which three bamboo poles are latched in a triangular pattern with overlapping ends, to form the airframe for cloth sails. This device lifts 300 pounds to a height of 20 feet in one minute in a 10 mph wind. G.G.

N74-16772* Army Air Mobility Research and Development Lab., Moffett Field, Calif.
ROTOR DYNAMIC CONSIDERATIONS FOR LARGE WIND POWER GENERATOR SYSTEMS
Robert A. Ormiston *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 80-88 ref (For availability see N74-16757 08-03)
CSCL 10B

Successful large, reliable, low maintenance wind turbines must be designed with full consideration for minimizing dynamic response to aerodynamic, inertial, and gravitational forces. Much of existing helicopter rotor technology is applicable to this problem. Compared with helicopter rotors, large wind turbines are likely to be relatively less flexible with higher dimensionless natural frequencies. For very large wind turbines, low power output per unit weight and stresses due to gravitational forces are limiting factors. The need to reduce rotor complexity to a minimum favors the use of cantilevered (hingeless) rotor configurations where stresses are relieved by elastic deformations. Author

N74-16773* Boeing Vertol Co., Philadelphia, Pa.
THE EFFECT OF AERODYNAMIC PARAMETERS ON POWER OUTPUT OF WINDMILLS
W. Wiesner *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 89-95 (For availability see N74-16757 08-03)
CSCL 10B

Aerodynamic results for a study on windpower generation are reported. Windmill power output is presented in terms that are commonly used in rotary wing analysis, namely, power output as a function of drag developed by the windmill. Effect of tip

speed ratio, solidity, twist, wind angle, blade setting and airfoil characteristics are given. Author

N74-16774* Science Applications, Inc., La Jolla, Calif. Advanced Concepts Div.
VERTICAL AXIS WIND ROTORS: STATUS AND POTENTIAL
W. Vance *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 96-102 (For availability see N74-16757 08-03)
CSCL 10B

The design and application of a vertical axis wind rotor is reported that operates as a two stage turbine wherein the wind impinging on the concave side is circulated through the center of the rotor to the back of the convex side, thus decreasing what might otherwise be a high negative pressure region. Successful applications of this wind rotor to water pumps, ship propulsion, and building ventilators are reported. Also shown is the feasibility of using the energy in ocean waves to drive the rotor. An analysis of the impact of rotor aspect ratio on rotor acceleration shows that the amount of venting between rotor vanes has a very significant effect on rotor speed for a given wind speed. G.G.

N74-16775* Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
ADVANTAGES OF THE DIFFUSER-AUGMENTED WIND TURBINE
R. A. Oman and K. M. Foreman *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 103-106 refs (For availability see N74-16757 08-03)
CSCL 10B

Performance optimization for a wind turbine is realized by using a shrouded diffuser to produce up to twice the power of unshrouded turbines of the same diameter. The diffuser converts the kinetic energy of the flow downstream of the rotor into a pressure rise and thus makes it possible for the rotor to capture airflow from a free stream tube area that is greater than that from the rotor itself. The flow velocity through the shrouded rotor is 20 to 60 percent greater than the free wind velocity as opposed to 67 percent less for the unshrouded case. The diffuser also makes it possible to accommodate very high wind speeds without the need of variable pitch in the rotor blades. G.G.

N74-16776* California State Univ., San Diego.
BUCKET ROTOR WIND-DRIVEN GENERATOR
Howard H. Chang and Horace McCracken (Sunwater Co.) *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 107-108 (For availability see N74-16757 08-03)
CSCL 10B

As compared with the ordinary propeller type rotor, the bucket rotor is limited in rotational speed since the tip rotor speed can never exceed the wind speed. However, it does not present the blade fatigue problem that the ordinary rotor has, and it perhaps causes less sight pollution. The deflector vanes also provide a venturi passage to capture greater wind flow. The bucket rotors can be strung together end-to-end up to thousands of feet long to produce large amounts of power. Author

N74-16777* Wisconsin Univ., Madison.
WIND-POWERED ASYNCHRONOUS AC/DC/AC CONVERTER SYSTEM
D. K. Reitan *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 109-114 refs (For availability see N74-16757 08-03)
CSCL 10B

Two asynchronous ac/dc/ac systems are modelled that utilize wind power to drive a variable or constant hertz alternator. The first system employs a high power 60-hertz inverter tie to the large backup supply of the power company to either supplement them from wind energy, storage, or from a combination of both at a preset desired current; rectifier and inverter are identical and operate in either mode depending on the silicon control rectifier firing angle. The second system employs the same rectification but from a 60-hertz alternator arrangement; it provides mainly dc output, some sinusoidal 60-hertz from the wind bus and some high harmonic content 60-hertz from an 800-watt inverter. G.G.

N74-16778* Oklahoma State Univ., Stillwater.
AN ELECTRICAL GENERATOR WITH A VARIABLE SPEED INPUT: CONSTANT FREQUENCY OUTPUT
H. Jack Allison *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 115-120 (For availability see N74-16757 08-03)
CSCL 10B

A new type of rotary energy conversion device for obtaining a desired constant frequency output independent of the speed of the prime mover has been developed and tested using the technique of field modulation and solid state alternator output processing. A 10-kilowatt prototype field modulated frequency down converter system was designed, built, and successfully tested. Experimentally obtained performance characteristics are presented. Author

N74-16779* Tompkin (Joseph), Salem, Ore.
VOIGHT VARIABLE SPEED DRIVE
Joseph Tompkin *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 121-122 (For availability see N74-16757 08-03)
CSCL 10B

The variable speed drive transmission is mounted within the gondola and connected with the wind turbine blades and the hub. This unit is designed for the production of ac power. The turbine turns by means of the variable speed drive and a set of synchronous three phase generators. This motion is controlled automatically by two wind rosettes in such a way that the wind turbine always opposes the wind direction. The Voight variable speed drive is a mechanical variable positive drive gear transmission. It has an unlimited power and torque transmission, a constant ratio with high degree of accuracy, a speed variation over a wide range, and a nonslip drive. Author

N74-16780* Oklahoma State Univ., Stillwater.
ENERGY STORAGE USING HIGH PRESSURE ELECTROLYSIS AND METHODS FOR RECONVERSION
William L. Hughes *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 123-129 (For availability see N74-16757 08-03)
CSCL 10C

Theoretical and experimental studies on high pressure electrolysis producing hydrogen and oxygen for energy storage and reconversion are reported. Moderate temperature, high pressure hydrogen/oxygen fuel cells with nickel electrodes are investigated for effects of pressure, temperature, and membrane porosity. Test results from an aphodid burner turbine generator combination obtained 40 percent kilowatt hours out of the fuel cell divided by kilowatt hours into the electrolyzer. It is concluded that high pressure hydrogenation of organic materials can be used to synthesize hydrozenes and methanes for making synthetic vehicular fuels. G.G.

N74-16781* General Electric Co., Santa Barbara, Calif.
USE OF HYDROGEN AND HYDROGEN-RICH COMPONENTS AS A MEANS OF STORING AND TRANSPORTING ENERGY
Walter Hausz *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 130-134 (For availability see N74-16757 08-03)
CSCL 10C

A one-megawatt wind energy source is assumed that uses half of its output to serve customers as electricity, and stores the other half by conversion to hydrogen, to liquid hydrogen, to stored LH2, and back to electricity. Energy costs and capital costs of the conversions escalate unit costs to 12.9 cents per kilowatt hour. High conversion costs can be reduced by using Mg2NiH4 and FeTiH2 storage, or by using a 100- or 1000 megawatt system. G.G.

N74-16782* General Electric Co., Lynn, Mass.
STATUS AND APPLICABILITY OF SOLID POLYMER ELECTROLYTE TECHNOLOGY TO ELECTROLYTIC HYDROGEN AND OXYGEN PRODUCTION
W. A. Titterington *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 135-136 (For availability see N74-16757 08-03)
CSCL 10B

The solid polymer electrolyte (SPE) water electrolysis technology is presented as a potential energy conversion method for wind driven generator systems. Electrolysis life and performance data are presented from laboratory sized single cells (7.2 sq in active area) with high cell current density selected (1000 ASF) for normal operation. Author

N74-16783* Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SUPERFLYWHEEL ENERGY STORAGE SYSTEM
David W. Rabenhorst *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 137-145 refs (For availability see N74-16757 08-03)
CSCL 10B

A windpowered system using the superflywheel configuration for energy storage is considered. Basic elements of superflywheels are thin rods assembled in pregrooved hub lamina so that they fan out in radial orientation. Adjacent layers of hub lamina are assembled 90 degree in rotation to each other so as to form a circular brush configuration. Thus stress concentrations and rod failure are minimized and realistic failure containment for a high performance flywheel is obtained. G.G.

N74-16784* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BATTERIES FOR STORAGE OF WIND-GENERATED ENERGY
Harvey J. Schwartz *In its* Wind Energy Conversion Systems Dec. 1973 p 146-151 (For availability see N74-16757 08-03)
CSCL 10C

Cost effectiveness characteristics of conventional-, metal gas-, and high energy alkali metal-batteries for wind generated energy storage are considered. A lead-acid battery with a power density of 20 to 30 watt/hours per pound is good for about 1500 charge-discharge cycles at a cost of about $80 per kilowatt hour. A zinc-chlorine battery that stores chlorine as solid chlorine hydrate at temperatures below 10 C eliminates the need to handle gaseous chlorine; its raw material cost are low and inexpensive carbon can be used for the chlorine electrode. This system has the best chance to replace lead-acid. Exotic alkali metal batteries are deemed too costly at the present stage of development. G.G.

N74-16785* InterTechnology Corp., Warrenton, Va.
ENERGY STORAGE BY COMPRESSED AIR
George C. Szego *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 152-154 (For availability see N74-16757 08-03)
CSCL 10C

The feasibility of windpower energy storage by compressed air is considered. The system is comprised of a compressor, a motor, and a pump turbine to store air in caverns or aquifiers. It is proposed that storage of several days worth of compressed air up to 650 pounds per square inch can be used to push the aquifier up closer to the container dome and thus initiate piston action by simply compressing air more and more. More energy can be put into it by pressure increase or pushing back the water in the aquifier. This storage system concept has reheat flexibility and lowest cost effectiveness. G.G.

N74-16786* Jacobs Wind Electric Co., Inc., Fort Meyers, Fla.
EXPERIENCE WITH JACOBS WIND-DRIVEN ELECTRIC GENERATING PLANT, 1931 - 1957
Marcellus L. Jacobs *In* NASA. Lewis Res. Canter Wind Energy Conversion Systems Dec. 1973 p 155-158 (For availability see N74-16757 08-03)
CSCL 10B

Engineering, construction, performance, electric output, and different uses of the wind electric 2500- to 3000-watt plant are outlined. After several years of testing different types of windmills, the three blade aeroplane type of propeller was found to be far superior in power output. By means of a flyball governor operated, variable pitch speed control, the maximum speed of the propeller was accurately and easily controlled, to prevent excessive speeds in high winds and storms. The three blade propeller was found to be necessary to prevent excessive vibration whenever the shift of the wind direction required the plant to change its facing direction on the tower. Author

N74-16787* McGill Univ., Montreal (Quebec). MacDonald Coll.
REVIEW OF THE WINDPOWER ACTIVITIES AT THE BRACE RESEARCH INSTITUTE
T. A. Lawand *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 159-164 refs (For availability see N74-16757 08-03)
CSCL 10B

A chronology of windpower studies at the experimental station on Barbados is presented that includes the various development activities on wheeling windmills whose power output is utilized through electrical and electronic systems. A list of institute publications on windpower is included. G.G.

N74-16788* Solar Wind Co., East Holden, Maine.
WIND POWER SYSTEMS FOR INDIVIDUAL APPLICATIONS
Henry M. Clews *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 165-169 (For availability see N74-16757 08-03)
CSCL 10B

A small windpower system is described which is suitable for electrifying a house. The self-contained unit consists of a two kilowatt wind driven generator, a set of 19 storage batteries, a small dc to ac inverter, and a gasoline generator for use as an emergency backup system in case of prolonged calm periods. Cost effectiveness of the electricity generated by this windmill system comes out to about 15 cents per kilowatt hour - assuming a 10 year life for the batteries and a 20 year life for the other components. Some other small windpower systems are also described, and it is shown that a windpowered generator in the 15- to 25-kilowatt output range coupled to a direct heated water storage system is able to heat a typical New England home. G.G.

N74-16789* Pennwatt Corp., Houston, Tex.
ECONOMIC CONSIDERATIONS OF UTILIZING SMALL WIND GENERATORS
Robert Dodge *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 170-173 (For availability see N74-16757 08-03)
CSCL 10B

The economic feasibility of small wind generators is compared to that of solar cells, primary batteries, thermoelectric generators, and engine generators. It is shown that small wind generator plants offer an attractive alternative to primary battery systems and constantly running engines to generate power in remote areas. The limitation is an annual average wind velocity of at least 9 to 10 mph. Presently available units are most useful in the average load range of 10 to 1000 watts. G.G.

N74-16790* Hydro-Quebec Inst. for Research, Varennes.
WIND UTILIZATION IN REMOTE REGIONS: AN ECONOMIC STUDY
James H. VanSant *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 174-176 (For availability see N74-16757 08-03)
CSCL 10C

A wind driven generator was considered as a supplement to a diesel group, for the purpose of economizing fuel when wind power is available. A specific location on Hudson's Bay, Povognituk, was selected. Technical and economic data available for a wind machine of 10-kilowatt nominal capacity and available wind data for that region were used for the study. After subtracting the yearly wind machine costs from savings in fuel costs, a net savings of $1400 per year is realized. These values are approximate, but are though to be highly conservative. Author

N74-16791* Montana State Univ., Bozeman.
TECHNICAL FEASIBILITY STUDY FOR THE DEVELOPMENT OF A LARGE CAPACITY WIND POWERED ELECTRICAL GENERATING SYSTEM
Ralph E. Powe *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 177-179 (For availability see N74-16757 08-03)
CSCL 10C

The engineering feasibility of developing a basic mechanical system necessary for extracting large amounts of power (on the

order of 10 to 20 MW) from the wind is considered using the concept of vertical airfoils moving along a closed horizontal track system. Attention is focused on those components necessary for the conversion of wind energy to mechanical energy, although the general characteristics and critical aspects of other components are also considered. The four phases of this program are: (1) Establishment of component specifications and interface requirements for major system components; (2) formulation of alternative sets of conceptual designs for major system components; (3) engineering analysis of various components and systems; and (4) re-examination of basic concept and identification of any desirable follow-up work. Author

N74-16792* Oregon State Univ., Corvallis.
THE OREGON STATE UNIVERSITY WIND STUDIES
Robert E. Wilson *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 180-185 (For availability see N74-16757 08-03)
CSCL 10C

The economic feasibility of commercial use of wind generated power in selected areas of Oregon is assessed. A number of machines for generating power have been examined. These include the Savonius rotor, translators, conventional wind turbines, the circulation controlled rotor and the vertical axis winged turbine. Of these machines, the conventional wind turbine and the vertical axis winged turbine show the greatest promise on the basis of the power developed per unit of rotor blade area. Attention has been focused on the structural and fatigue analysis of rotors since the economics of rotary winged, wind generated power depends upon low cost, long lifetime rotors. Analysis of energy storage systems and tower design has also been undertaken. An economic means of energy storage has not been found to date. Tower design studies have produced cost estimates that are in general agreement with the cost of the updated Putnam 110-foot tower. Author

N74-16793* Aerowatt Corp., Paris (France).
FRENCH WIND GENERATOR SYSTEMS
John M. Noel *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 186-196 (For availability see N74-16757 08-03)
CSCL 10B

The experimental design of a wind driven generator with a rated power of 800 kilovolt amperes and capable of being connected to the main electrical network is reported. The rotor is a three bladed propeller; each blade is twisted but the fixed pitch is adjustable. The asynchronous 800-kilovolt ampere generator is driven by the propeller through a gearbox. A dissipating resistor regulates the machine under no-load conditions. The first propeller on the machine lasted 18 months; replacement of the rigid propeller with a flexible structure resulted in breakdown due to flutter effects. Author

N74-16794* Massachusetts Univ., Amherst.
A PROPOSED NATIONAL WIND POWER R AND D PROGRAM
William Heronemus *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 197-203 (For availability see N74-16757 08-03)
CSCL 10B

An offshore wind power system is described that consists of wind driven electrical dc generators mounted on floating towers in offshore waters. The output from the generators supplies underwater electrolyzer stations in which water is converted into hydrogen and oxygen. The hydrogen is piped to shore for conversion to electricity in fuel cell stations. It is estimated that this system can produce 159 x 10 to the ninth power kilowatt-hours per year. It is concluded that solar energy - and that includes wind energy - is the only way out of the US energy dilemma in the not too distant future. Author

N74-16795* Budgen and Associates, Pointe Claire (Quebec).
A COMMENT ON TOWERS FOR WINDMILLS
Harry P. Budgen *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 204-205 (For availability see N74-16757 08-03)
CSCL 10B

Design considerations for windmill tower structures include the effects of normal wind forces on the rotor and on the tower. Circular tabular or masonry towers present a relatively simple aerodynamic solution. Economic factors establish the tubular tower as superior for small and medium sized windmills. Concrete and standard concrete block designs are cheaper than refabricated steel structures that have to be freighted. G.G.

N74-16796* Stuttgart Univ. (West Germany).
SOME EXTEMPORANEOUS COMMENTS ON OUR EXPERIENCES WITH TOWERS FOR WIND GENERATORS
Ulrich Hutter *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 206-207 (For availability see N74-16757 08-03)
CSCL 10B

A wind generator tower must be designed to withstand fatigue forces and gust winds loads. Optimum tower height depends on the energy cost to the customer because an increase in height results in an increase in the cost of the plant. It is suggested that costs are minimum for the shortest tower possible and that the rotor should be as large as possible. G.G.

N74-16797* AeroVironment, Inc., Pasadena, Calif.
WIND MACHINES **c20**
P. B. S. Lissaman *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 208-239 (For availability see N74-16757 08-03)
CSCL 04B

The basic elements of the air/water momentum exchange are described by the environment, the potential, the air and water subsystems, the total system, and the rule. Many of these topics have direct analogues in aerogenerator design. Aspects of optimal sail design and of waveless hulls are briefly outlined. A wind driven vehicle capable of moving directly downwind faster than the wind, is reported. The lecture is illustrated with slides and movie clips showing surfing catamarans, land and water versions of the Bauer vehicle, hang gliding, land sailing, and wind surfing. Author

N74-16798* National Science Foundation, Washington, D.C.
NSF PRESENTATION
Frederick H. Morse *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 240-243 (For availability see N74-16757 08-03)
CSCL 10B

Wind energy conversion research is considered in the framework of the national energy problem. Research and development efforts for the practical application of solar energy -- including wind energy -- as alternative energy supplies are assessed in: (1) Heating and cooling of buildings; (2) photovoltaic energy conversion; (3) solar thermal energy conversion; (4) wind energy conversion; (5) ocean thermal energy conversion; (6) photosynthetic production of organic matter; and (7) conversion of organic matter into fuels. G.G.

N74-16799* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA PRESENTATION
Ronald L. Thomas *In its* Wind Energy Conversion Systems Dec. 1973 p 244-253 (For availability see N74-16757 08-03)
CSCL 10B

The development of a wind energy system is outlined that supplies reliable energy at a cost competitive with other energy systems. A government directed industry program with strong university support is recommended that includes meteorological studies to estimate wind energy potentials and determines favorable regions and sites for wind power installations. Key phases of the overall program are wind energy conversion systems, meteorological wind studies, energy storage systems, and environmental impact studies. Performance testing with a prototype wind energy conversion and storage system is projected for Fiscal 1977. G.G.

N74-16800*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
H2-O2 COMBUSTION POWERED STEAM-MHD CENTRAL POWER SYSTEMS
G. R. Seikel, J. M. Smith, and L. D. Nichols 1974 14 p refs Presented at Hydrogen Economy Miami Energy Conf., Miami

Beach, Fla., 18-20 Mar. 1974; sponsored by Univ. of Miami
(NASA-TM-X-71512; E-7890) Avail: NTIS HC $3.00 CSCL 10B

Estimates are made for both the performance and the power costs of H2-O2 combustion powered steam-MHD central power systems. Hydrogen gas is assumed to be transmitted by pipe from a remote coal gasifier into the city and converted to electricity in a steam MHD plant having an integral gaseous oxygen plant. These steam MHD systems appear to offer an attractive alternative to both in-city clean fueled conventional steam power plants and to remote coal fired power plants with underground electric transmission into the city. Author

N74-16801*# Linguistic Systems, Inc., Cambridge, Mass.
USING THE ENERGY OF THE WIND FOR ELECTRIFICATION
V. R. Sektorov Washington NASA Feb. 1974 18 p Transl. into ENGLISH from Elektrichestvo, (USSR), no. 3 March 1953 p 11-16
(Contract NASw-2482)
(NASA-TT-F-15307) Avail: NTIS HC $4.00 CSCL 10A

The utilization of wind energy for generating electric power is discussed. Existing power generators utilizing wind energy are described and their use in agriculture is indicated. Author

N74-16802*# Scientific Translation Service, Santa Barbara, Calif.
THE ECONOMY AND PRACTICALITY OF LARGE SCALE WIND GENERATION STATIONS (CONCLUSION)
H. Witte Washington NASA Feb. 1974 15 p refs Transl. into ENGLISH from Elektrotech. Z. (Berlin-Charlottenburg), v. 59, no. 52, 29 Dec. 1938 p 1404-1407
(Contract NASw-2483)
(NASA-TT-F-15348) Avail: NTIS HC $4.00 CSCL 10B

The design and operational problems of wind power generating stations are discussed. Wind power generating stations are found to be economical for operation in conjunction with existing generating stations. Very large ring generator stations are described. Author

N74-16803*# Linguistic Systems, Inc., Cambridge, Mass.
A WIND PLANT TO POWER SEA SIGNALS
F. Baumeister Washington NSA Feb. 1974 17 p Transl. into ENGLISH from elektrotech. Z. (Berlin-Charlottenburg), v. 7, no. 12, 21 Dec. 1955 p 437-441
(Contract NASw-2482)
(NASA-TT-F-15356) Avail: NTIS HC $4.00 CSCL 10B

On the basis of the experience with the Schleimunde windpower plant, it may be said in conclusion that economic operation of such a windpower plant is feasible whenever, on the one hand, the cost of connecting the consumers to the public network is prohibitive, and on the other hand sufficient wind is available. The planning of long term duration and force reading is of particular value. It is advantageous to erect windpower plants in coastal and mountain regions. Author

N74-16804*# General Electric Co., Cincinnati, Ohio.
DEVELOPMENT OF A MERCURY ELECTROMAGNETIC CENTRIFUGAL PUMP FOR THE SNAP-8 REFRACTORY BOILER DEVELOPMENT PROGRAM Final Report
R. A. Fuller and A. W. Schnacke Washington NASA Feb. 1974 77 p refs
(Contract NAS3-10610)
(NASA-CR-2375) Avail: NTIS HC $4.00 CSCL 18N

An electromagnetic pump, in which pressure is developed in mercury because of the interaction of the magnetic field and current which flows as a result of the voltage induced in the mercury contained in the pump duct, was developed for the SNAP-8 refractory boiler test facility. Pump performance results are presented for ten duct configurations and two stator sizes. These test results were used to design and fabricate a pump which met the SNAP-8 criteria of 530 psi developed pressure at 12,500 lb/hr. The pump operated continuously for over 13,000 hours without failure or performance degradation. Included in this report are descriptions of the experimental equipment, measurement techniques, all experimental data, and an analysis of the electrical losses in the pump. Author

N74-16805*# General Electric Co., Lynn, Mass. Aircraft Equipment Div.
ACID ELECTROLYTE FUEL CELL TECHNOLOGY PROGRAM Final Report, 1 Oct. 1971 - 15 May 1973
12 Oct. 1973 69 p
(Contract NAS9-12332)
(NASA-CR-134186; SPR-113) Avail: NTIS HC $6.50 CSCL 10A

The development of an acid electrolyte fuel cell was investigated to provide a cost effective electrical power system for the space shuttle orbiter. Previous investigation showed the life capability of the fuel cell was improved by proper prehumidification of the reactant gases. Breadboard models were developed which incorporate reactant prehumidification and have a life duration time of 2000 hours. Fuel cell performance was found to be invariant with cell life, and reactant consumption was unchanged from start to end of life. Satisfactory start and stop procedures are demonstrated along with scale-up capabilities for the number of cells in a stack, and for cell active areas. Safety design features, which operate to isolate the affected module from the remainder of the system, to eliminate single point failure modes from affecting the entire electrical power system are included. S.K.W.

N74-16806*# TRW Systems Group, Redondo Beach, Calif.
ASDTIC CONTROL AND STANDARDIZED INTERFACE CIRCUITS APPLIED TO BUCK, PARALLEL AND BUCK-BOOST dc TO dc POWER CONVERTERS Final Report, Aug. 1971 - Nov. 1972
A. D. Schoenfeld and Y. Yu Feb. 1973 128 p refs
(Contract NAS3-14392)
(NASA-CR-121106; TRW-21083-6001-RU-00) Avail: NTIS HC $9.50 CSCL 10A

Versatile standardized pulse modulation nondissipatively regulated control signal processing circuits were applied to three most commonly used dc to dc power converter configurations: (1) the series switching buck-regulator, (2) the pulse modulated parallel inverter, and (3) the buck-boost converter. The unique control concept and the commonality of control functions for all switching regulators have resulted in improved static and dynamic performance and control circuit standardization. New power-circuit technology was also applied to enhance reliability and to achieve optimum weight and efficiency. Author

N74-16807*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
INVERSION LAYER SOLAR CELL FABRICATION AND EVALUATION Final Report
R. L. Call Sep. 1973 95 p Prepared for JPL
(Contracts NAS7-100; JPL-953461)
(NASA-CR-136932) Avail: NTIS HC $8.00 CSCL 10A

Silicon solar cells operating with induced junctions rather than diffused junctions have been fabricated and tested. Induced junctions were created by forming an inversion layer near the surface of the silicon by supplying a sheet of positive charge above the surface. This charged layer was supplied through three mechanisms: (1) applying a positive potential to a transparent electrode separated from the silicon surface by a dielectric, (2) contaminating the oxide layer with positive ions, and (3) forming donor surface states that leave a positive charge on the surface. A movable semi-infinite shadow delineated the extent of sensitivity of the cell due to the inversion region. Measurements of the response of the inversion layer cell to light of different wavelengths indicated it to be more sensitive to the shorter wavelengths of the sun's spectrum than conventional cells. The greater sensitivity occurs because of the shallow junction and the strong electric field at the surface. Author

N74-16808*# TRW Systems Group, Redondo Beach, Calif.
A STUDY OF DEGRADATION OF PLATES FOR NICKEL-CADMIUM SPACECRAFT CELLS Interim Report
Willard R. Scott Nov. 1973 55 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953649)
(NASA-CR-136863; TRW-24118-6001-RU-00) Avail: NTIS HC $5.75 CSCL 10B

The relative merits of coining and not coining of sintered nickel-oxide and cadmium plates was investigated. A survey of the industry including cell manufactures and users was made

and results summarized. Sample plate materials from most commercial cell suppliers were obtained and characterized for properties that may correlate with the tendency toward physical disintegration during handling and over long periods of time in the cell. Special test methods were developed to obtain comparative data in a short time. A wide range of physical properties and coining thicknesses was observed, resulting in a range of responses. The stronger, less brittle materials resisted loss of sinter better than weaker materials whether or not coined. Coining improved handling and resistance to electrochemical cycling in all materials tested. An apparent exception was found to be due to improper coining of a tapered edge. Author

N74-16809# Brookhaven National Lab., Upton, N.Y.
HYDROGEN ECONOMY
V. L. Sailor 1973 23 p refs Presented at Seminar on Novel Power Sources for a Power Hungry World, Baltimore Sponsored by AEC
(BNL-18224) Avail: NTIS HC $3.25

A brief discussion is given of the possibilities of synthetic-fuel energy conversion cycles. The advantages and disadvantages of using coal and oil shale products are indicated. Environmental and economical problems which remain during the product of synthetic fuels from coal and oil shale, and the advantages and disadvantages of hydrogen as a synthetic fuel are outlined. Technical problems involve storage and on-board tankage for vehicles and aircraft. Safety problems are also discussed. NSA

N74-16810# Sandia Labs., Albuquerque, N.Mex.
ECONOMIC COMPARISON OF TWO SOLAR/HYDROGEN CONCEPTS
W. H. McCulloch, R. B. Pope, and D. O. Lee Oct. 1973 12 p refs
(Contract AT(29-1)-789)
(SLA-73-900) Avail: NTIS HC $3.00

Two concepts for producing hydrogen from solar energy are examined. The utilization of solar energy and the concept of a hydrogen fuel both have drawbacks. Solar energy is intermittent, interrupted by the diurnal cycle of available sunlight and by weather conditions. Most systems designed to use solar energy include an expensive energy storage mechanism to meet demands during periods when there is no incident solar radiation. Hydrogen generation plants would require large amounts of energy input. The concepts described utilize parameters typical of operation in Albuquerque, New Mexico. It is assumed that the collectors are positioned with the axes in a northsouth plane, tilted 35 deg from the horizontal toward the south, with spacing between collectors equal to the collector dimensions. NSA

N74-16811# Centre d'Essai Aeronautique, Toulouse (France).
ROLE OF COMPUTERIZED SIMULATION IN THE PERFECTING AERONAUTICAL EQUIPMENTS OR SYSTEMS [CONTRIBUTIONS DE LA SIMULATION SUR CALCULATRICE A LA MISE AU POINT D'EQUIPEMENTS OU SYSTEMES AERONAUTIQUES]
Sep. 1973 29 p In FRENCH Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.50

The application of new methods of optimization, which exclude empirism by using functional equations verified by experimental results, and computer-aided simulation procedures, are discussed. These methods were applied to aircraft equipment, notably a hydraulic pump and an air intake system for the Concorde aircraft's air conditioning installation. In both cases it is shown that the simulation leads to optimal results. ESRO

N74-16812# Societe des Accumulateurs Fixes et de Traction, Romainville (France). Dept. Accumulateurs Alcalins.
STUDY OF NICKEL-CADMIUM BATTERIES FOR USE IN APPLICATIONS SATELLITES, PHASE 2. EVALUATION OF CHARGE STORAGE OF CHARGED Ni-Cd VO 23S BATTERIES [ETUDE DES ACCUMULATEURS Ni-Cd POUR UTILISATION DANS LES SATELLITES D'APPLICATION, PHASE 2. RAPPORT 02: EVALUATION DE LACONSERVATION DE CHARGE A L'ETAT CHARGE D'ACCUMULATEURS Ni-Cd VO 23 S]
S. Font Dec. 1972 12 p In FRENCH
(Contract ESTEC-1357/71-SL)
(DT/SAS-533/72-SF/JM; ESRO-CR(P)-324; Rept-02) Avail: NTIS HC $4.00

The electric charge storage of charged nickel cadmium batteries was evaluated. Results obtained at various storage temperatures using nineteen batteries VO 23S are tabulated. The evolution of capacity loss versus temperature is reported. ESRO

N74-16813# Societe des Accumulateurs Fixes et de Traction, Romainville (France). Dept. Accumulateurs Alcalins.
STUDY OF NICKEL-CADMIUM BATTERIES FOR USE IN APPLICATIONS SATELLITE, PHASE 2. EVALUATION OF ELECTRICAL IMPEDANCE AS A FUNCTION OF THE FREQUENCY AT VARIOUS TEMPERATURES AND CHARGE STATES OF Ni-Cd VO 23S BATTERIES [ETUDE DES ACCUMULATEURS Ni-Cd POUR UTILISATION DANS LES SATELLITES D'APPLICATION, PHASE 2. RAPPORT 04: EVALUATION DE L'IMPEDANCE EN FONCTION DE LA FREQUENCE A DIFFERENTS ETATS DE CHARGE ET TEMPERATURES D'ACCUMULATEURS Ni-C d VO 23S]
S. Font Feb. 1973 30 p In FRENCH
(Contract ESTEC-1358/72-SL)
(DT/SAS-176/73-SF/JM; ESRO-CR(P)-326; Rept-04) Avail: NTIS HC $4.50

A method for the measurement of the impedance is described, as well as the equipment used. The operational principles and calibration of the oscilloscope and the Wavetek generator are presented. Preliminary test results and experimental results are discussed, and the curves showing the variations of impedance versus frequency, and versus charge state, and of phase versus frequency are established. It is shown that the impedance of Ni-Cd VO 23S batteries is independent of the temperature and of the charge state in the 1 to 1,000,000 Hz range and depends only on the frequency. ESRO

N74-16814# Societe des Accumulateurs Fixes et de Traction, Romainville (France). Dept. d'Accumulateurs.
STUDY OF NICKEL-CADMIUM BATTERIES FOR USE IN APPLICATIONS SATELLITES, PHASE 3. STUDY AND ANALYSIS OF UTILIZATION MODES OF Ni-Cd BATTERY ELEMENTS Final Report [ETUDE DES ACCUMULATEURS Nd POUR UTILISATION DANS LES SATELLITES D'APPLICATION, PHASE 3. RAPPORT FINAL 08: ETUDE ET ANALYSE DES MODES D'UTILISATION DE BATTERIES D'ELEMENTS Ni-Cd]
S. Font Jul. 1973 43 p refs In FRENCH
(Contract ESTEC-1358/71-SL)
(DT/SAS-543/73-SF/JM; ESRO-CR(P)-330; Rept-08) Avail: NTIS HC $5.25

The operational modes of nickel-cadmium batteries are discussed with emphasis on the influence of some parameters, including the operating temperature, charge and discharge regimes, overcharge at each cycle, duration of cycle, and charging modes on cycling life of batteries. The optimal operational conditions for nickel cadmium batteries onboard geostationary satellites were determined. ESRO

N74-16815# Systems Research Labs., Inc., Dayton, Ohio.
KIVA-I MHD GENERATOR MODIFICATIONS AND TESTS Technical Report, 28 Feb. 1972 - 31 Mar. 1973
Lester W. Buechler and Robert A. Nimmo Aug. 1973 241 p refs
(Contract F33615-71-C-1425)
(AD-770063; AFAPL-TR-73-71) Avail: NTIS CSCL 10/2

The AFAPL-MHD Facility (KIVA-I) was used to conduct an extensive series of tests on the pegwall diagonally connected generator. Extensive knowledge was gained in the areas of conductivity, oxygen-to-fuel ratios, interelectrode connection angles, seed particle geometry, and optimum loading conditions. A peak power of 210 KW was achieved. A DC-to-DC Inverter was successfully operated on the MHD generator, providing an output of 50 KW at 50 KV dc. Numerous modifications were made to the KIVA-I facility, including a new high-speed data acquisition system, a close circuit television system, a pulse-control network for the main burner, a new set of pole faces for the magnet, a digital display panel, and an instrumented copper electrode assembly. Author (GRA)

N74-16816# Army Foreign Science and Technology Center, Charlottesville, Va.
DIRECT ENERGY CONVERSION METHODS
B. P. Nesterov and V. I. Rydnik 24 Jul. 1973 31 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no 7, 1971 p 32
(AD-770000; FSTC-HT-23-131-73) Avail: NTIS CSCL 10/2
Magnetohydrodynamic generators, thermoelectric and thermion generators are discussed. Data are presented for experimental installations of these generators in the Soviet Union. GRA

N74-16817# Army Foreign Science and Technology Center, Charlottesville, Va.
REVERSIBILITY OF LEAD ELECTRODES IN ALKALINE ELECTROLYTES
V. A. Sidorov and V. N. Flerov 17 Oct. 1973 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. (Moscow), v. 14, no. 9, 1971 p 1393-1396
(AD-770533; FSTC-HT-23-1014-73) Avail: NTIS CSCL 10/3
The use of the Pb electrode in an Ag-Pb storage battery is increased by the addition of CdO to the Pb electrode and by addition of Na2SiO3 solution to the KOH electrolyte. GRA

N74-16818# Harry Diamond Labs., Washington, D.C.
DEVELOPMENT OF AN AIR-DRIVEN ALTERNATOR FOR 60 MM MORTAR APPLICATION, PHASE 2
Carl J. Campagnuolo and Jonathan E. Fine May 1973 53 p
(DA Proj. 1W5-64602-D-028)
(AD-765479; HDL-TM-73-7) Avail: NTIS CSCL 10/2
An air-driven alternator that was developed to provide electrical energy and a second safing signature for the 60-mm Multioption Fuze for mortars was tested successfully in the wind tunnel, in a rain field, and in extreme temperature environment conditions. The alternator design was modified so that it can be fabricated from low-cost stamped parts in large quantities. The new design satisfies the electrical power requirements of the fuze. Author (GRA)

N74-16819# Army Construction Engineering Research Lab., Champaign, Ill.
ADVANCED ELECTRICAL POWER GENERATION AND DISTRIBUTION CONCEPTS FOR MILITARY FACILITIES
Jun. 1973 134 p refs
(DA Proj. 4A0-62112-A-891)
(AD-765476; CERL-PR-E-13) Avail: NTIS CSCL 10/2
The report describes probable technical advancement of electrical power generation systems in the 1980-1990 time period for application in fixed or semi-fixed military facilities in the power range of 250 kw to 50,000 kw. Subjects covered include commerical power reliability, uninterruptible power system, conventional steam, diesel, gas turbine (open and closed cycle) generators and distribution systems for currently available equipment. Advanced power systems include nuclear reactors, batteries and fuel cells, magnetohydrodynamic systems, fusion systems, solar power systems and direct conversion systems of the thermoelectric and thermionic type. (Modified author abstract) GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-16820*# Techtran Corp., Glen Burnie, Md.
RESISTANCE AND DISEASE. PROBLEMS OF GENERAL PATHOLOGY
P. D. Gorizontov Washington NASA Feb. 1974 45 p Transl. into ENGLISH from Patol. Fiziol. Ekstremal'nykh Sostoyaniy, (Moscow), 1973 p 7-35
(Contract NASw-2485)
(NASA-TT-F-15314) Avail: NTIS HC $5.25 CSCL 06E
Resistance to disease is presented from the pathological viewpoint of the organism's reaction mechanisms, their regulation, stimulation, effect, reduced effectiveness and resultant change of effect. The role of stress is emphasized. General functional disturbances are dealt with in characterizing basic features of resistance and protection. Author

N74-16821*# Techtran Corp., Glen Burnie, Md.
THE PATHOGENIC EFFECT OF ELECTRICAL CURRENT
G. L. Frenkl, K. A. Azhibayev, I. K. Mishchenko, P. D. Gorizontov, ed., and N. N. Sirotinin, ed. Washington NASA Feb. 1974 27 p refs Transl. into ENGLISH from the book "Patologicheskaya Fiziologiya Ekstremal'nykh Sostoyaniy" Moscow, Meditsina Press, 1973 p 145-159
(Contract NASw-2485)
(NASA-TT-F-15319) Avail: NTIS HC $4.50 CSCL 06S
The history of study of injuries due to electric current is traced. The effect of physical parameters (current path, voltage, resistance, current strength) of the condition of the organism, and environmental factors on electrtrauma are investigated. Forms of death attributable to the effects of electric current are described. Treatment is devoted to electric shock and exogenic effects. Prophylaxis and therapy of electrotraumata are briefly considered. Author

N74-16822*# Linguistic Systems, Inc., Cambridge, Mass.
EXPERIMENTAL RESTRAINT ULCER IN THE WHITE RAT. 3: STUDY AND ANALYSIS OF THE PART PLAYED BY CERTAIN PSYCHOLOGICAL FACTORS
S. Bonfils, G. Liefooghe, X. Gelle, M. Dubrasquet, A. Lambling, and N. Enjolvy Washington NASA Feb. 1974 25 p refs Transl. into ENGLISH from Rev. Fr. Etud. Clin. Biol. (France), v. 5, 1960 p 571-581
(Contract NASw-2482)
(NASA-TT-F-15329) Avail: NTIS HC $4.25 CSCL 06C
Rats studied during restraint were found to go through three motor phases: continuous, uncontrolled agitation; paroxymal, intermittent agitation; and prolonged inertia. There was no correlation between the release reaction and the incidence of ulcers, mortality, or weight loss. It may be concluded that the release reaction is not the pathogenic stimulus in restraint and is not related to it. A quantitive assessment of the psychological stimulus imposed by enforced immobilization was attempted on 503 normal and 400 vagotomized rats, confined in five different volumes from 360 to 7350 ml. The smaller the restraint space, the more frequent the ulcers. There was a statistically significant difference between normal and vagotomized rats, the slope of the regression line being flatter in the latter. Author

N74-16823*# Techtran Corp., Glen Burnie, Md.
CHANGE IN RESPIRATION OF RAT LIVER MITOCHONDRIA DURING PROLONGED HYPOKINESIS
L. N. Grinberg Washington NASA Feb. 1974 9 p refs Transl. into ENGLISH from Vop. Med. Khim. (Moscow), v. 16, 1970 p 387-390
(Contract NASw-2485)
(NASA-TT-F-15386) Avail: NTIS HC $4.00 CSCL 06C
Limitation of movement of periods of 10 and 20 days did not cause changes in the respiratory activity of rat liver mitochondria. Hypokinesis for a period of 30 days lead to an increase in mitochondrial respiration in the fourth state and into a decrease in the rate of respiration in the third state. A decrease in the magnitude of respiratory control was detected in the mitochondria under the influence of a 30-day long period of hypokinesis which was partially compensated for by the 60th day of the experiment. The magnitude of respiratory control after Chance-Williams was the most sensitive parameter which permitted estimates of change in the respiratory chain of mitochondira under the influence of hypokinesis. Author

N74-16824*# Techtran Corp., Glen Burnie, Md.
CHANGES IN THE GAS METABOLISM, GAS HOMEOSTASIS AND TISSUE RESPIRATION IN THE RAT DURING PROLONGED HYPOLINESIS
V. L. Popkov, E. S. Mailyan, Yu. S. Galushko, Ye. A. Kovalenko, Ye. I. Zaytseva, I. A. Nitochkina, L. V. Smulova, and A. V. Ryazhskiy Washington NASA Feb. 1974 11 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 56, no. 12, 1970 p 18-08-1812
(Contract NASw-2485)
(NASA-TT-F-15393) Avail: NTIS HC $4.00 CSCL 06C

Among the white rats kept in confining cages to limit motor activity of the animals, the overall gas metabolism and intratissue gas homeostasis did not significantly change over the course of the 60-day long experiment period. However, the intensity of respiration of certain tissues changed; in the liver it increased, in the myocardium it decreased. The physical working capacity underwent a five-fold decrease. The 60-day long period of hypokinesis caused retarded growth of the animals. Author

N74-16825*# Techtran Corp., Glen Burnie, Md.
THE MECHANISM OF DEVELOPMENT OF AORTIC ANEURYSM IN RABBITS DURING LIMITATION OF THEIR MOBILITY
V. V. Tyavokin Washington Feb. 1974 10 p refs Transl. into ENGLISH from Kardiologiya (USSR), v. 12, Sep. 1972 p 139-143
(Contract NASw-2485)
(NASA-TT-F-15397) Avail: NTIS HC $4.00 CSCL 06C

Twenty male rabbits of the chinchilla breed were divided into 6 groups and were tested for the development of aortic aneurysm under conditions of limited mobility. Aneurysms were successfully produced in regions where a ligature was applied to the aorta. Two sites for the application of the ligature were chosen; one in the thoracic region and one in the abdominal region. In the thoracic region aneurysms were successfully produced using both the ligature and natural constrictions by the animals' hiatus aorticus. The experiments confirmed that limited mobility in the application of constriction to the aorta produce aneurysms. This is in direct conflict with works published earlier to the effect that constriction alone and applied from the outside will not produce aneurysms. In the case of the abdominal ligature renal disorders are both a result and a contributing factor to the formation of abdominal aneurysm of the aorta. Author

N74-16826# Battelle-Northwest, Richland, Wash.
PACIFIC NORTHWEST LABORATORY ANNUAL REPORT FOR 1972 TO THE USAEC DIVISION OF BIOMEDICAL AND ENVIRONMENTAL RESEARCH. VOLUME 2: PHYSICAL SCIENCES. PART 2: RADIOLOGICAL SCIENCES
J. M. Nielsen et al Apr. 1973 125 p refs
(Contract AT(45-1)-1830)
(BNWL-1751-Pt-2) Avail: NTIS

The atmospheric concentrations of Pu238 Pu239 were measured in surface air samples collected at Richland, Washington from 1963 to 1972. The amount of SNAP-9A burnup Pu238 Pu239 present was calculated from the Pu238 concentrations and the Pu238/Pu239 ratios, assuming that the ratio in debris from nuclear weapons tests was 0.015. Calculations had indicated that the Pu238 Richland air from 1967 to 1971 came primarily from SNAP-9A. From 1967 to 1969 the concentrations of SNAP-9A plutonium at Richland had remained fairly constant, indicating that the Pu238 was being transferred across the equator into the Northern Hemisphere at a rate comparable to the rate at which Pu238 was being deposited on the earth's surface. The Pu 238 concentrations showed seasonal variations typical of radionuclides of stratospheric origin, so the transfer was probably taking place primarily in the stratosphere. Concentrations of SNAP-9A plutonium at Richland have decreased rapidly since that time. NSA

N74-16827# Defence Research Information Centre, Orpington (England).
PHOTORESPIRATION AND THE PRIMARY REACTIONS OF PHOTOSYNTHESIS
B. Loetsch Sep. 1973 21 p refs Transl. into ENGLISH from Ber. Deut. Bot. Ges. (Stuttgart), v. 2, no. 83, 1970 p 41-54 (DRIC-Trans-3293; BR30618) Avail: NTIS HC $4.25

Under suitable experimental conditions, it is possible to demonstrate a light-dependent carbon dioxide production (and oxygen consumption) in higher plants. This so-called photorespiration is not connected with mitochondrial respiration (which seems to be even inhibited in light), but is closely related to the primary reactions of photosynthesis. To clarify this connection with the light driven electron flow, a comparative biological demonstration of the much discussed two quantum scheme of photosynthesis was determined. As a result, it is not clear that an automatic coupling of the photochemical splitting of water (to produce reduction energy) with the non-cyclic photophosphorylation (to gain energy as ATP) has emerged in the course of biological evolution. Author (ESRO)

N74-16828# Defence Research Information Centre, Orpington (England).
DEEP DIVING WITH SYNTHETIC MIXTURES OF GASES
A. Zetterstroem Nov. 1973 22 p Transl. into ENGLISH from Tex. Tidsskr. (Stockholm), no. 75, 1945 p 173-178
(DRIC-Trans-3386; BR30684) Avail: NTIS HC $4.25

The eventual use of gas mixtures for diving is briefly outlined, and the advantages to be gained from such mixtures are discussed. The physiology of diving and the effects of the traditional gases - oxygen and nitrogen - are described. The possible use of different gases such as helium and hydrogen in combination with oxygen and/or nitrogen is discussed and the inherent problems together with tests are considered. ESRO

N74-16829*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ULTRASTRUCTURAL PATHOGENESIS OF LESIONS PRODUCED BY EXPOSURE TO OXYGEN DIFLUORIDE WITH CORRELATIVE LIGHT MICROSCOPY
Gladys Harrison and William Mackenzie (AMRL, Wright-Patterson AFB, Ohio) Jul. 1973 56 p refs
(AF Proj. 6302)
(NASA-TM-X-69865; AD-770292; AMRL-TR-72-107) Avail: NTIS HC $6.00 CSCL 06T

The lungs of rats exposed to OF2 were examined by light and electron microscopy. The exposures were for 30 to 60 minutes to an average of 4.5 ppm OF2, the minimal lethal dose. Animals were sacrificed after 30 (group 1) and 60 minutes (group 2) exposure and 1 (group 3) and 2 (group 4) hours following 60 minutes exposure. Mild gross changes were observed in groups 3 and 4, but no light microscopic lesions were found. Alterations were noted in all four groups using electron microscopy. These were mostly indicative of fluid change and consisted of blebbing of the endothelial and epithelial layers of the alveolocapillary wall and rarification of the cytoplasm of these cells. The lamellar bodies of the Type II cells showed an increasing and consistent loss of matrix structure and density. These fine structural changes increased in quantity and severity as time of exposure or post-exposure period increased. (Modified author abstract) GRA

N74-16830# Naval Aerospace Medical Research Lab., Pensacola, Fla.
EXPOSURE OF MAN TO MAGNETIC FIELDS ALTERNATING AT EXTREMELY LOW FREQUENCY
Dietrich E. Beischer, James D. Grissett, and Robert E. Mitchell Jul. 1973 36 p refs
(AD-770140; NAMRL-1180) Avail: NTIS CSCL 06/18

Ten subjects were confined for periods up to 7 days and during this time were exposed to a low-intensity magnetic field (.0001 Wb/sq m at 45 Hz) for periods up to 24 hours. Five subjects were confined but were not exposed. A large battery of physiological and psychophysiological tests were given throughout the confinement period. No effects were seen that could be definitely linked with the magnetic field. The only changes that could be correlated with the time course of exposure to the ELF magnetic field were in serum triglycerides of blood samples drawn 14 hours after the evening meal. In nine of the ten exposed subjects, serum triglycerides reached a maximum value 24 to 48 hours after the ELF field exposure. Similar trends were not seen in any of the five control subjects. (Modified author abstract) GRA

N74-16831# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
RELATION BETWEEN DAILY NOISE EXPOSURE AND HEARING LOSS BASED ON THE EVALUATION OF 6,835 INDUSTRIAL NOISE EXPOSURE CASES Final Report
William L. Baughn (Gen. Motors Corp., Anderson, Ind.) Jun. 1973 41 p refs Prepared in cooperation with EPA
(AD-767204; EPA-550-73-001-C) Avail: NTIS HC $3.00 CSCL 06/19

The percent of a population exhibits greater than certain specified audiometric hearing levels as a function of specified exposure levels and duration of exposures to those levels.

Audiometric data from 6835 employees of an industrial plant were taken during the period from 1960 through 1965. The employees were selected only on the criterion that their noise exposures were reasonably well known. Hearing levels for each of three exposure conditions were obtained for the speech and the 4 kHz audiometric frequencies. The data are smoothed and hearing risk tables are presented. Author (GRA)

N74-16832# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
THE COMBINED EFFECTS OF VIBRATION, NOISE, AND EXPOSURE DURATION ON AUDITORY TEMPORARY THRESHOLD SHIFT Final Report, Jul. 1972 - Mar. 1973
Henry C. Sommer Sep. 1973 20 p refs
(AF Proj. 7231)
(AD-770285; AMRL-TR-73-34) Avail: NTIS CSCL 06/19

To determine the combined effects of noise and vibration on auditory function, the temporary threshold shifts (TTS) of two groups of 10 subjects each were measured as a function of intensity and duration of exposure. Combined noise and vibration was presented to one group for 5 minutes and to the other for 20 minutes. Both groups were exposed to vibration in the Z axis at frequencies of 9 Mz and 18 Hz at intensity levels of 0.475 gz (peak) and 0.950 gz, respectively. Noise levels of 90 db and 100 db were presented simultaneously with the vibration. TTS was measured at post exposure recovery times of 0.5, 2.0, 5.0, 10.0, and 20.0 minutes. Although the mean difference was small (0.72 db), a significantly larger TTS was obtained at 9 Hz than 18 Hz vibration, and 100 db produced a larger TTS than 90 db. Significant differences in TTS were also obtained as a function of duration of exposure, and as a function of post exposure recovery time. (Modified author abstract) GRA

N74-16833# School of Aerospace Medicine, Brooks AFB, Tex.
CORRELATION OF EYE-LEVEL BLOOD FLOW VELOCITY AND BLOOD PRESSURE DURING PLUS G SUB z ACCELERATION Final Report, Jul. 1972 - Jun. 1973
Robert W. Krutz, Jr., S. A. Rositano, and R. E. Mancini Nov. 1973 8 p refs
(AF Proj. 7930)
(AD-770560; SAM-TR-73-36) Avail: NTIS CSCL 06/1

Eye-level blood flow and blood pressure changes were correlated on the USAFSAM human centrifuge during both rapid onset (ROR, 1G/sec) and gradual onset runs (GOR, 0.1 G/sec). A transcutaneous Doppler ultrasonic flowmeter was used to monitor temporal artery blood flow (Qta); direct blood pressure was obtained by cannulation of a radial artery and measured at eye level with a Statham P-37 miniature transducer. Eye-level mean blood pressure (Pa) decreased to 20 mm Hg and zero forward Qta occurred 6 sec (range 4-9 sec) prior to blackout in experienced centrifuge subjects during RORs. The same degree of correlation was not seen during GORs. Author (GRA)

N74-16834# Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.
DIELECTRIC ANALYSIS OF BIOMATERIALS
Arthur R. VonHippel, Alah H. Runck, and William B. Westphal Oct. 1973 26 p refs
(Contract N00014-67-A-0204-0053; NR Proj. 105-632)
(AD-769843; TR-13) Avail: NTIS CSCL 06/16

After introducing the frequency range and operating methods of dielectric analysis in general terms, the report reviews shortly the present state of knowledge about freezing injury, the role of water in living systems, the effects of dissolved ions, and the unique role of protons. Subsequently it shows that protons act quite differently than anticipated and that ions and molecules in frozen systems display surprising changes of action and unsuspected interactions as function of temperature. Studies on erythrocytes make clear that dielectric analysis can become a diagnostic tool for the measurement of cell permeability and changes of cell content. Methods and instrumentation for deep tumor therapy are proposed, based on the presently known dielectric characteristics of the human body. Author (GRA)

N74-16835# School of Aerospace Medicine, Brooks AFB, Tex.
RETINAL BURN THRESHOLDS FOR EXPOSURE TO A FREQUENCY DOUBLED NEODYMIUM LASER Final Report, 4 Apr. - 5 Jun. 1973
William D. Gibbons Nov. 1973 16 p refs
(AF Proj. 6301)
(AD-770561; SAM-TR-73-45) Avail: NTIS CSCL 06/18

The eyes of rhesus monkeys were exposed to the radiation from a frequency-doubled neodymium laser. Retinal damage was assessed with a fundus camera at one hour and 24 hours after exposure. The threshold for a 50% probability of damage (ED50) was determined from the data. The threshold for a single 15-nsec pulse using the one-hour lesion appearance criterion was determined to be 3.02 microjoules per pulse at the cornea. Author (GRA)

N74-16836# Defense Documentation Center, Alexandria, Va.
MOTION SICKNESS Report Bibliography, Apr. 1942 - Jan. 1973
Nov. 1973 152 p refs
(AD-769950/7GA) Avail: NTIS HC $4.75 CSCL 06/19

The references contain information pertinent to an understanding of the fundamental causes of motion sickness and an evaluation of the drugs used in prevention and treatment of air and sea sickness. The indexes included are Corporate Author-Monitoring Agency, Subject, Title, Personal Author and Contract Number. Author (GRA)

N74-16837# Frankford Arsenal, Philadelphia, Pa.
CW NEODYMIUM OCULAR DAMAGE THRESHOLD STUDY. ONE-SECOND EXPOSURE DURATION Interim Report
David J. Lund, Charles T. Carver, and William E. Zwicker Aug. 1973 16 p
(DA Proj. 1T0-61102-A-31C)
(AD-770404; FA-M73-25-1) Avail: NTIS CSCL 06/18

A continuous-wave neodymium laser, operating at 1.06 micron has been incorporated into an animal exposure facility to enable the determination of the threshold for damage to ocular tissue at this wavelength for a range of exposure durations. Using Rhesus monkeys, the damage threshold has been determined for 1-second exposure duration and minimal retinal spot size. Damage was produced at exposure levels above 42 millijoules total intraocular energy (TIE). The ED50 level was 56.4 millijoules TIE. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-16838*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
DEVELOPMENT OF A HOUSEHOLD WASTE TREATMENT SUBSYSTEM, VOLUME 1 Final Report
Thomas M. Gresko and Robert W. Murray Oct. 1973 68 p refs
(Contract NAS1-11770)
(NASA-CR-132342-Vol-1) Avail: NTIS HC $6.50 CSCL 06I

The domestic waste treatment subsystem was developed to process the daily liquid and non-metallic solid wastes provided by a family of four people. The subsystem was designed to be connected to the sewer line of a household which contained water conservation features. The system consisted of an evaporation technique to separate liquids from solids, an incineration technique for solids reduction, and a catalytic oxidizer for eliminating noxious gases from evaporation and incineration processes. All wastes were passed through a grinder which masticated the solids and deposited them in a settling tank. The liquids were transferred through a cleanable filter into a holding tank. From here the liquids were sprayed into an evaporator and a spray chamber where evaporation occurred. The resulting vapors were processed by catalytic oxidation. Water and latent energy were recovered in a combination evaporator/condenser heat exchanger. The solids were conveyed into an incinerator and reduced to ash while the incineration gases were passed through the catalytic oxidizer along with the processed water vapor. Author

N74-16839*# General Electric Co., Philadelphia, Pa.
DOMESTIC WATER AND WASTE TREATMENT SUBSYSTEM, OPERATION AND MAINTENANCE MANUAL, VOLUME 2
T. M. Gresko and R. W. Murray Oct. 1973 28 p
(Contract NAS1-11770)
(NASA-CR-132342-Vol-2) Avail: NTIS HC $4.50 CSCL 06I

The domestic water and waste treatment subsystem is designed to operate for a period of one year with maintenance. Subsystem operating instructions and maintenance procedures are listed along with a trouble shooting and component disassembly guide. Author

N74-16840*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DEVELOPMENT AND FABRICATION OF HEAT-STERILIZABLE INHALATION THERAPY EQUIPMENT
A. S. Irons 15 Jan. 1974 76 p refs
(Contract NAS7-100)
(NASA-CR-136832; JPL-TM-33-670) Avail: NTIS HC $7.00 CSCL 06L

The development of a completely heat sterilizable intermittent positive pressure breathing (IPPB) ventilator in an effort to reduce the number of hospital acquired infections is reported. After appropriate changes in materials and design were made, six prototype units were fabricated and were successfully field tested in local hospitals. Most components of the modified ventilators are compatible with existing machines. In all but a few instances, such as installation of bacteria-retentive filters and a modified venturi, the change over from non-heat-sterilizable to sterilizable units was accomplished by replacement of heat labile materials with heat stable materials. Author

N74-16841*# Scientific Translation Service, Santa Barbara, Calif.
AN IMPROVED MECHANICAL PLETHYSMOGRAPH FOR THE HAND AND DISTAL FOREARM
Sh. Figar Washington NASA Jan. 1974 8 p refs Transl. into ENGLISH from Physiol. Bohemoslov., (Czechslovakia), v. 8, 1959 p 75-78
(Contract NASw-2483)
(NASA-TT-F-15234) Avail: NTIS HC $4.00 CSCL 06L

A description is given of a mechanical hydraulic plethysmograph for the hand and distal forearm with a suitably shaped plethysmographic vessel placed in a water bath, which is at the same time a water supply reservoir with a calibration unit. Practically linear mechanical ink recording and a suitable means of sealing and immobilizing the extremity being tested are reported. Author

N74-16842*# Techtran Corp., Glen Burnie, Md.
A SIMPLE DEVICE FOR COLLECTING BLOOD SAMPLES FROM SUBJECTS UNDERGOING ACCELERATION IN A CENTRIFUGE
F. Rossangio Washington NASA Feb. 1974 6 p Transl. into ENGLISH from Riv. Med. Aeronaut. Spaz., (Italy) v. 28, Jan. - Mar. 1965 p 77-81
(Contract NASw-2485)
(NASA-TT-F-15387) Avail: NTIS HC $4.00 CSCL 06B

A device is reported for the appropriate collection of blood samples from subjects undergoing forces of acceleration. It consists of two collection units, each equipped with two syringes which permit the collection of two useful blood samples by means of a catheter located inside the circulatory system of the patient to be examined, while the centrifuge is in operation. The blood collection unit is calibrated to permit the gathering of samples of venous and arterial blood during operation of a centrifuge to 15 g. Author

N74-16843*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
DESIGN DEVELOPMENT AND TEST: TWO-GAS ATMOSPHERE CONTROL SUBSYSTEM Final Report
John K. Jackson 1 Feb. 1974 139 p refs
(Contract NAS9-12924)
(NASA-CR-134190; MDC-G4971) Avail: NTIS HC $10.00 CSCL 06K

An atmosphere control subsystem (ACS) was developed for NASA-IBJSC which is designed to measure the major atmospheric constituents in the manned cabin of the space shuttle orbiter and control the addition of oxygen and nitrogen to maintain the partial pressures of these gases within very close limits. The ACS includes a mass spectrometer sensor (MSS) which analyzes the atmosphere of a shuttle vehicle pressurized cabin, and an electronic control assembly (ECA). The MSS was built and tested to meet the requirements for flight equipment for the M-171 Metabolic Analyzer experiment for the Skylab flight program. The instrument analyzes an atmospheric gas sample and produces continuous 0-5 vdc analog signals proportional to the partial pressures of H2, O2, N2, H2O, CO2 and total hydrocarbons having a m/e ratio between 50 and 120. It accepts signals from the MSS proportional to the partial pressures of N2 and O2 and controls the supply of these gases to the closed cabin. Author

N74-16844*# ILC Industries, Inc., Dover, Del.
DEVELOPMENT OF EMERGENCY INTRAVEHICULAR SPACESUIT (EIS) ASSEMBLY Final Report
17 Oct. 1973 95 p
(Contract NAS9-12995)
(NASA-CR-134191; ER-852-29) Avail: NTIS HC $7.75 CSCL 06Q

A program was undertaken to develop and test two prototype pressure suits to operate at pressures up to 413 mm Hg (8.0 PSIG). The units were designated Emergency Intravehicular Spacesuits (EIS). Performance requirements, design evolution, testing performed, problems encountered, and final EIS configuration are reported. Author

N74-16845*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ROBOT ARM DYNAMICS AND CONTROL
A. K. Bejczy 15 Feb. 1974 156 p refs
(Contract NAS7-100)
(NASA-CR-136935; JPL-TM-33-669) Avail: NTIS HC $11.00 CSCL 05H

Variations in total inertia and gravity loads at the joint outputs are treated along with the relative importance of gravity and acceleration-generated reaction torques or forces versus inertia torques or forces. The relation between the dynamical state equations in explicit terms and servoing the manipulator is briefly discussed in the framework of state variable feedback control which also forms the basis of adaptive manipulator control. Exact state equations were determined for total inertia and gravity loads at the joint outputs as a function of joint variables, using the constant inertial and geometric parameters of the individual links defined in the respective link coordinate frames. The range of maximum variations in total inertia and gravity loads at the joint outputs was calculated for both no load and load in the hand. The main result is the construction of a set of greatly simplified state equations which describe the total inertia and gravity load variations at the output of the six joints with an average error of less than 5%. Author

N74-16846*# Washington Univ., St. Louis, Mo. Communications Group.
HOW TO MAKE THE FOURTH REVOLUTION: HUMAN FACTORS IN THE ADOPTION OF ELECTRONIC INSTRUCTIONAL AIDS
Nicholas J. Demerath and Lois A. Daniels Dec. 1973 85 p refs
(Grant NGR-26-008-054)
(NASA-CR-136862; Memo-73/5) Avail: NTIS HC $7.25 CSCL 05E

The prospects and problems of getting higher education in the United States (high school and above) to more fully utilize electronic technologies are examined. Sociological, psychological, and political factors are analyzed to determine the feasibility of adopting electronic instructional techniques. Differences in organizations, attitudes, and customs of different kinds of students, teachers, administrators, and publics are crucial factors in innovation. S.K.W.

N74-16847# Defense Documentation Center, Alexandria, Va.
ENVIRONMENTAL POLLUTION: NOISE POLLUTION-NOISE EFFECTS ON HUMAN PERFORMANCE Bibliography Report,

Jan. 1971 - May 1973
Nov. 1973 168 p refs
(AD-769900; DDC-TAS-73-69) Avail: NTIS CSCL 06/19

The bibliography is comprised of 111 citations of unclassified reports dealing with Environmental Pollution; Noise Pollution - Noise Effects on Human Performance in a series of bibliographies on Environmental Pollution. References deal primarily with effects of noise exposure on hearing, speech, communications and community/airport noise. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included. Author (GRA)

N74-16848# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF PROLONGED NON-FLYING PERIODS ON PILOT SKILL IN PERFORMANCE OF A SIMULATED CARRIER LANDING TASK M.S. Thesis
Wayne Bruce Wilson Sep. 1973 42 p refs
(AD-769696) Avail: NTIS CSCL 05/9

An experiment was undertaken to determine if a significant loss of basic pilot skill occurs during prolonged non-flying periods. Current, one-year stagnant and two-year stagnant groups of jet qualified Naval Aviators were tested on a computer simulation of a carrier approach and landing. Performance by currency groupings was then analyzed. Test subjects were subsequently re-assigned to experience groups, according to total actual flight hours accrued by each pilot. Least experienced, intermediate and most experienced group performance was then compared. Significant variables and important parameters in retention of pilot skills are discussed. In light of the experimental results, some possible real-world implications and suggestions are made. Author (GRA)

N74-16849# School of Aerospace Medicine, Brooks AFB, Tex.
BREATHING OXYGEN SYSTEMS: CONTAMINANTS IN OXYGEN DESORBED FROM FLUOMINE Progress Report, Nov. 1972 - Mar. 1973
Leonard J. Luskus, Richard L. Miller, Herman J. Kilian, and Kenneth G. Ikels Nov. 1973 19 p refs
(AF Proj. 7164)
(AD-770020; SAM-TR-73-37) Avail: NTIS CSCL 06/11

Fluomine, bis (3-fluorosalicylaldehyde) ethylenediimine cobalt (II), is a metal chelate which reversibly absorbs oxygen and is of current interest in the Air Force's search for oxygen concentration systems to be used for generating aviator's breathing oxygen onboard aircraft. Oxygen from this chelate was evaluated for the degree of contamination by toxic substances arising via degradation of the chelate and/or impurities introduced into the chelate during preparation, handling, and storage. Specifically, Fluomine was repeatedly run through sorption-desorption cycles, and the product oxygen was analyzed for contamination using infrared spectroscopy, gas chromatography, and mass spectrometry. (Modified author abstract) GRA

N74-16850# Paul Sabaiter Univ., Toulouse (France). Lab. of Medical Biology.
EFFECT OF AUTOGAMY ON CELLULAR SENSITIVITY TO NATURAL IONIZING RADIATION AND X-RAYS Final Scientific Report, 1 Jun. - 31 Oct. 1972
H. Planel, J. P. Soleilhavoup, R. Tixador, F. Croute, and G. Richoilley 13 Apr. 1973 13 p refs
(Grant AF-AFOSR-4210-72; AF Proj. 9767)
(AD-761837; EOAR-TR-73-12) Avail: NTIS CSCL 06/18

It is shown that, after autogamy, there is a large decrease of radiosensitivity of Paramecium aurelia to natural ionizing radiations or to X-rays. These modifications come in addition to the well known physiological changes induced by conjugation or autogamy in Paramecium. The origin of these modifications cannot be determined. Nevertheless, nuclear reorganisation involved by autogamy may explain the modifications of chromosome number may result in large fluctuation of radiosensitivity in many species. New investigations are in progress to try to determine the mechanism involved in cellular response to natural ionizing radiation. (Modified author abstract) GRA

N74-16851# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF HUMAN MENTAL AND MOTOR RESPONSES TO HEAT STRESS M.S. Thesis
Gilbert Wayne Bratschi Sep. 1973 36 p refs
(AD-769699) Avail: NTIS CSCL 06/19

An investigation into the physiological reactions of persons being artificially acclimatized to extreme heat conditions in an environmental chamber was conducted. While the subjects were being artificially acclimatized they performed low-skill tasks. Their performance was compared to that attained outside of the chamber after acclimatization. Parameters measured were pulse rate, oral temperature, decision making rate, time on target, and two different reaction times. Analysis of the extracted data indicated a correlation between the decision making task and the pursuit rotor task and showed that each of these was correlated with oral temperature. Also, results suggested that the process of artificial acclimatization had not adversely effected the abilities of the subjects to later perform in a normal environment. Author (GRA)

N74-16852*# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THRESHOLDS FOR THE PERCEPTION OF ANGULAR ACCELERATION AS INDICATED BY THE OCULOGYRAL ILLUSION
Earl F. Miller, II and Ashton Graybiel 11 Jun. 1973 22 p refs
(NASA Order T-81633; NASA Order T-5904-B)
(NASA-CR-136927; AD-769268; NAMRL-1168) Avail: NTIS HC $4.25 CSCL 06/16

The oculogyral illusion may be perceived by a person passively exposed to angular acceleration as apparent motion (in the direction of turn) of visual objects that are fixed relative to him. The illusion has its genesis in the semicircular canals and a knowledge of cupuloendolymph mechanisms, the role of adaptation effects and the influence of secondary etiological factors are all essential for predicting its behavior under different stimulus conditions. Studies have shown that its perception under ideal test conditions yields lower threshold values than other canal response indicators; the manifestation of nystagmus, and the sensation and aftersensation of rotation. The thresholds of the illusion are so low that their measurement is limited by the precision of the rotating device. A highly sophisticated servo-controlled device, the Rotating Litter Chair (RLC), was developed expressly for determining with this indicator any changes in cupular thresholds of response that might occur during the prolonged weightless Skylab missions. The purpose of the report is to evaluate the RLC and a relatively short method for determining the thresholds of perception of the illusion in a large sample of normal subjects and in four deaf persons with severe bilateral labyrinthine defects. GRA

N74-16853# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
AIR-TO-GROUND TARGET ACQUISITION WITH NIGHT VISION DEVICES
S. MacLeod and R. L. Hilgendorf 1973 8 p refs Presented at the Annual Meeting of Society of, San Diego, Calif., 27-29 Aug. 1973
(AF Proj. 7184)
(AD-769345; AMRL-TR-73-87) Avail: NTIS CSCL 05/10

Three hand-held image intensifiers were studied. Two of these were passive visual aids (Starlight Scope and Uniscope) and one was an IR viewer (Find-R-Scope). These devices were evaluated in terms of number of targets (trucks, boats, village) recognized on a 1000:1 scale terrain model. Simulated air-to-ground views of 20 observers were provided as they circled the model at a simulated 520 MPH and 8500 ft slant range under a moonlight illumination level. Although all targets were visible through the devices when observers were shown when and where to look, almost no target recognition occurred when any of the aids were used in a search viewing-mode under the conditions of the study. Author (GRA)

N74-16854# Hughes Aircraft Co., Culver City, Calif. Engineering Equipment Div.
OPTIMIZED OPTICAL LINK FOR HELMET MOUNTED DISPLAY Final Report
Eric R. Fehr Sep. 1973 19 p ref
(Contract F33615-71-C-1673; AF Proj. 7184)
(AD-770307; HAC-P72-72; AMRL-TR-73-20) Avail: NTIS CSCL 05/5

An optimized optical link helmet mounted display (OOLHMD) system designed to satisfy requirements for a large-field-of-view, large-exit-pupil, high-resolution, helmet-mounted visually-coupled display device is described. The history and development of the basic concept is traced, and principal design considerations and requirements constituting the basis of the selected OOLHMD configuration are identified. Advantages and disadvantages of several alternative designs are also considered, and a comprehensive discussion of the benefits to be realized through use and application of the OOLHMD concept in lieu of displays permanently mounted within an aircraft cockpit is given.
Author (GRA)

N74-16855# Douglas Aircraft Co., Inc., Long Beach, Calif.
INVESTIGATION OF FLARE PATTERNS AS A MEANS OF OVERCOMING SPATIAL DISORIENTATION OCCURRING UNDER NIGHT STRIKE CONDITIONS Final Report, Oct. 1972 - Aug. 1973
David M. Zamarin, Richard F. Gabriel, and L. Dean Rickerd Sep. 1973 115 p refs
(Contract F33615-73-C-4063; AF Proj. 7184)
(AD-770309; MDC-J6092; AMRL-TR-73-95) Avail: NTIS CSCL 05/5

Pilot interview data and analytic investigation indicated that the night attack environment was particularly hazardous with respect to spatial disorientation. Fifteen pilot subjects performed a tracking task representative of recovery from unusual attitudes while simultaneously being subjected to rotationally induced disorientation in a simulated cockpit. Motion pictures of geometric arrangements of flare patterns were presented for use as an orientation aid. Performance was evaluated against an attitude indicator and a no disorientation condition. In addition to tracking parameters, results were evaluated on the basis of pilot opinion, body reactions, eye movement recordings and perceptual tests. Results indicated that air-dropped flares arranged in a triangular pattern were effective in establishing attitude control under conditions of disorientation. (Modified author abstract) GRA

N74-16856# Naval Electronics Lab. Center, San Diego, Calif.
NAVSHIPS DISPLAY ILLUMINATION DESIGN GUIDE. SECTION 2: HUMAN FACTORS Technical Document, Apr. 1972 - Jan. 1973
Howard J. Heglin Jul. 1973 257 p refs
(AD-770478; NELC-TD-223) Avail: NTIS CSCL 05/5

Human factors guidelines are provided - supported by research data, tables, graphs, and charts - for general reference by designers concerned with display illumination. Consideration is given to trade-offs between ambient illumination, local illumination for design areas, and self-emanating and projected displays. Sample specification materials are included. Author (GRA)

N74-16857# Robotics, Inc., Elnora, N.Y.
APPLYING FORCE FEEDBACK SERVOMECHANISM TECHNOLOGY TO MOBILITY PROBLEMS Final Report
Ralph S. Mosher Aug. 1973 206 p refs
(Contract DAAE07-72-C-0109; DA Proj. 1T6-62601-A-045)
(AD-769952; TACOM-TR-11768; LL-144) Avail: NTIS CSCL 05/8

The report summarizes force feedback servomechanism research performed under the sponsorship of TACOM, and the advanced Project Research Agency, with the purpose of defining and exploring possible new approaches in the design of mobility aids. The fundamentals of manipulative man-machine control technology are reviewed. Factors contributing to effective bilateral servo design are discussed. Human factors related to force feedback controls are described. The development of a quadruped walking mechanism employing bilateral force feedback controls and spatial correspondence between operator controls and machine appendages is discussed in detail. A series of experiments with the quadruped test bed is described. (Modified author abstract) GRA

N74-16858# Naval Postgraduate School, Monterey, Calif.
GRIP PRESSURE AS A MEASURE OF TASK DIFFICULTY IN COMPENSATORY TRACKING TASKS M.S. Thesis
John Howard Hickok 28 Feb. 1974 50 p refs
(AD-769744) Avail: NTIS CSCL 05/10

The feasibility of utilizing the grip pressure exerted on a rigid control stick as a measure of tracking task difficulty was investigated. A device was engineered to measure grip pressure independent of control force. A hybrid computer was used to produce the tracking tasks necessary in the research and on-line data computation. Compensatory tracking tasks using specified controlled elements provided the difficulty levels, from easiest to most difficult. (Modified author abstract) GRA

N74-16859# Dayton Univ. Research Inst., Ohio.
BONE STRENGTH AND IN-FLIGHT MECHANICAL STRESSES Annual Report, 15 May 1972 - 15 May 1973
G. A. Graves and F. Noyes (AMRL, Wright-Patterson AFB, Ohio) 15 Jul. 1973 54 p refs
(Contract F44620-71-C-0083; AF Proj. 9777)
(AD-769969; AFOSR-73-1998TR; AR-2) Avail: NTIS CSCL 06/12

Sixteen ceramic samples were implanted in mature rhesus monkeys for periods of 105, 130, and 150 days. The sixteen samples consisted of four groups, each group containing a different amount of phosphorus to determine the effect of compositional variations on the ceramic microstructure, its behavior in a physiological environment and the response of the surrounding bone and soft tissue to the varying composition and/or pore structure. In addition, implant studies in rabbits have shown no biochemical effects due to the presence of the ceramic. Investigations have shown that both composition and pore structure are extremely important in the in-vivo behavior of the ceramic relative to bone ingrowth and resorbtion. (Modified author abstract) GRA

N74-16860# Brain Systems International, Inc., Waban, Mass.
COLORED FILTERS AS FACTORS IN IMPROVING HUMAN VISUAL ACUITY Final Report
Whitman A. Richards Sep. 1973 55 p refs
(Contract F33615-72-C-1342; AF Proj. 7183)
(AD-770310; BSI-01083; AMRL-TR-73-100) Avail: NTIS CSCL 05/10

When a yellow (minus blue) is placed before an observer's eyes most observers report an increase in brightness of the field viewed. This brightness increase occurs even though the radiant energy reaching the retinae is reduced. The magnitude of the effect is about 25% for filters customarily used for yellow goggles, and is restricted to photopic viewing conditions. This study examines the possibility that there may be a correlated improvement in acuity when the brightness of the field is enhanced by introducing yellow filters. (Modified author abstract) GRA

N74-16861# Institute of Environmental Medicine and Physiology, Seattle, Wash.
INSTRUCTION MANUAL FOR THE IEMP DOPPLER ULTRASONIC PRECORDIAL BLOOD BUBBLE DETECTOR Final Report, 1 Nov. 1971 - 31 Dec. 1972
Merrill P. Spencer, David C. Johanson, and Howard F. Clarke 15 Feb. 1973 49 p refs
(Contract N00014-72-C-0095)
(AD-765369) Avail: NTIS CSCL 06/2

A report is presented detailing the operation of a 5 MHz Doppler ultrasonic bubble detector developed for use in detection of venous gas emboli formed in the blood of divers during decompression as well as for monitoring craniotomies, cardiopulmonary bypass equipment and other medical procedures where there is danger of aeroembolism. A precordial sensor employing 1/2 inch square resonant transmitting and receiving crystals separated by 2 cm and focused 2-7 cm retrosternal is emloyed for the detection of all gas emboli returning in the veins to the right heart and lungs, the precordial sensor being positioned to the left of the midsternal border over the pulmonary artery and right ventricle. Author (GRA)

N74-16862# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TARGET VIGILANCE EFFECTS FROM VISUAL OBSTRUCTIONS IMPOSED BY HELMET-MOUNTED DISPLAY HARDWARE Final Report
L. Ralph Chason, Jock C. H. Schwank, and Richard L. Hughes Aug. 1973 42 p refs
(AF Proj. 7184)
(AD-770297; AMRL-TR-73-17) Avail: NTIS CSCL 05/10

The response times to and correct identification of target stimuli superimposed on panoramic scenes were measured under conditions of restriction and nonrestriction of peripheral vision. Twenty-five male subjects were assigned randomly to experimental conditions and required to search for target stimuli under simulated visual flight conditions of varying color and terrain features. A simulated helmet-mounted device was used to restrict peripheral vision. The data are viewed as supporting the position that the intrusion of a helmet-mounted device into a pilot's field of view can result in a significant decrement to his target vigilance performance. Possible implications in human engineering design and subsequent research efforts are discussed. (Modified author abstract) GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-16863 Illinois Inst. of Tech., Chicago.
MEAN ADSORPTION LIFETIMES OF CESIUM CHLORIDE ON NICKEL SURFACES Ph.D. Thesis
Leo Woei-Tih Huang 1973 344 p
Avail: Univ. Microfilms Order No. 73-27054

A pulsed molecular beam method was applied to the study of the mean adsorption CsCl on single crystal and polycrystaline nickel surfaces. The experiments were conducted in an ultrahigh vacuum system free of hydrocarbon contaminates and with pressures less than 2 x 10 to the minus 8th power torr. A molecular beam of CsCl was formed from species effusing from a double oven effusion cell equipped with a conical orifice. A rotating chopper served to pulse the molecular beam; the CsCl molecular beam was on for 5.84% of the period of the cycle. The molecular beam struck a nickel target which was mounted at a 45 deg angle to the molecular beam. Four targets were used in these experiments: Ni(3) surface, Ni(100) surface, clean polycrystalline Ni surface, and a contaminated polycrystalline Ni surface. The mean adsorption lifetimes were determined by measuring the rate of evaporation of CsCl from the surface by means of a surface ionization detector. Dissert. Abstr.

N74-16864# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
PREPARATION OF POLY(2-BUTENE 1,4-DIOL DINITRATE) [DARSTELLUNG VON POLYBUTEN(2)-DIOLDINITRAT (1,4)]
K. M. Bucerius 21 Dec. 1972 42 p refs In GERMAN
(ICT-10/72) Avail: NTIS HC $5.25

In the search for new stable polymer explosives, attempts were made to synthesize poly 2-butene 1,4-diol dinitrate. The polymerization of four different kinds of starting products was studied: cis or trans 2-butene 1,4-diol; 2-butene 1,4-dinitrate; maleic acid anhydride and gamma-crotonflactone. Only the polymerization of maleic acid anhydride was successful, but it was not possible to reduce the polyanhydride to the corresponding polyalcohol. A small amount of low molecular poly 2-butene 1,4-diol dinitrate was obtained starting from cis or trans 2-butene 1,4-diol. Some physical properties of this polymer are discussed. ESRO

N74-16865# Shell Development Co., Houston, Tex.
VARIATION IN SHELL 405 CATALYST PHYSICAL CHARACTERISTICS, TEST CATALYST PREPARATION Final Report, May 1972 - May 1973
Walter L. Petty Jul. 1973 19 p refs
(Contract F04611-72-C-0077)
(AD-769888; AFRPL-TR-73-56) Avail: NTIS CSCL 07/4

This report describes the continuation of a study for the Air Force Rocket Propulsion Laboratory to develop a catalyst of the Shell 405 type with improved durability to repeated cold starts using monopropellant hydrazine. Besides furnishing some standard grades of Shell 405 Catalyst, three experimental catalysts containing 36%, 44%, and 55% iridium were prepared for evaluation by the AFRPL. Author (GRA)

N74-16866# Intelcom Rad Tech, San Diego, Calif.
MOLECULAR BEAM STUDY OF CO OXIDATION ON A (111) PLATINUM SURFACE
Robert L. Palmer and Joe N. Smith, Jr. 10 Sep. 1973 44 p refs
(Contract N00014-72-C-0247; NR Proj. 051-527)
(AD-770032; RT-8005-001; TR-2) Avail: NTIS CSCL 07/4

The heterogeneous oxidation of CO on epitaxially grown Pt(111) surfaces has been investigated using modulated molecular beam techniques. The overall reaction is apparently first order. The observance of higher order kinetics in these experiments is argued to be an artifact of the beam technique used here and suggests a high surface diffusion rate for adsorbed CO. The measured angular dependence of the CO2 desorption rate from the Pt(111) surfaces does not follow the Knudsen law of random (cosine) desorption, but is much more sharply peaked about the surface normal. The adsorption of CO is also shown to have an angular dependence and is not activated on Pt(111). The results of this study strongly suggest that a Langmuir-Hinshelwood mechanism dominates the reaction, with CO being the principal diffusing species. (Modified author abstract) GRA

N74-16867# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
EFFLUENT PLUME IMAGING Final Report, 26 Jun. 1972 - 31 Mar. 1973
J. B. Goodell, H. Bourg, G. Eesley, and D. Margerian Mar. 1973 21 p
(Contract DAAD05-72-C-0360)
(AD-770543; LWL-CR-02-C72) Avail: NTIS CSCL 07/4

The object of the study was to produce real time images from ambient temperature gases through their black or gray body radiation. The crucial stage of the laboratory experiments produced real time images of black body radiation from methane. Video tapes recorded a typical cycle which began with an infrared image of the cell without gas. As methane filled the cell, the previously dark end glowed with radiation from the strong methane bands in the 4-5 micrometer band. These experimental results verified theoretical predictions that gases can be detected, identified and imaged by passive techniques. (Modified author abstract) GRA

N74-16868# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
INVESTIGATION OF FACTORS AFFECTING CORROSION RATE DETERMINATION BY RESISTANCE POLARIZATION M.S. Thesis
Robert L. Kuhnle May 1973 377 p refs
(AD-770084; GAM/MC/73-8) Avail: NTIS CSCL 11/6

This investigation sought to design and test an apparatus for use in operating environments to reliably and accurately indicate, by galvanostatic resistance polarization techniques, the metal surface corrosion rate. Using two high purity iron specimens with different impurity content, tests were conducted in hydrogen saturated and aerated environments of 1N and 0.1N sulfuric acid and 3% sodium chloride/0.5N potassium sulfate. Both graphical and computerized linear regression techniques were used to determine specific run and average polarization resistance values. Weight-loss tests were conducted simultaneously with resistance polarization tests to provide comparative actual corrosion rate information. Actual corrosion damage was found most dependent upon grain orientation, electrolyte agitation, and the specific impurity content. (Modified author abstract) GRA

N74-16869# Utah Univ., Salt Lake City. Dept. of Chemistry.
RELAXATION STUDY OF THE ELECTRIC FIELD INDUCED HYDRODYNAMIC TURBULENCE IN NEMATIC LIQUID CRYSTALS BY RAMAN SCATTERING Technical Report, 1 Apr. 1973 - 31 Mar. 1974
S. Pan and C. H. Wang 21 Nov. 1973 18 p refs
(Contract N00014-67-A-0325-0007)
(AD-770595; TR-4) Avail: NTIS CSCL 07/4

Using Raman scattering, the authors have measured the relaxation time of the electric field induced hydrodynamic turbulence in the bulk of several nematic liquid crystal samples as a function of temperature. The induced hydrodynamic turbulence is absent in the solid as well as in the isotropic liquid phase, and thus is a specific property of the anisotropic character of

the bulk nematic material. The temperature dependent behavior of the liquid crystals with positive dielectric anisotropy (azo compounds) is found to be rather different from that with negative dielectric anisotropy (azoxy compounds). In both the azo and the azoxy compounds the relaxation time can all be fit to the Arrhenius type of activation process. It is suggested that the dipole-dipole interaction in the compounds of negative dielectric anisotropy is likely to play a very significant role in determining the relaxation behavior of the electrohydrodynamic instability in the bulk of nematic liquid crystal samples. (Modified author abstract) GRA

N74-16870# Army Foreign Science and Technology Center, Charlottesville, Va.

COMPOSITION AND CHEMICAL STABILITY OF MOTOR FUELS

Z. A. Zablina 1972 357 p refs Transl. into ENGLISH of the mono. "Sostav i Khimicheskaya Stabilnost Motornykh Topliv" Moscow, 1972 279 p

(AD-770538; FSTC-HT-23-1690-73) Avail: NTIS CSCL 21/4

The work concerns the chemical composition of hydrocarbon motor fuels and the chemical changes that occur from the time the fuels are produced until they are burned in the engine. Chapter One discusses both the hydrocarbon composition of fuels and the non-hydrocarbon ingredients. Chapter two deals with chemical changes during storage and in engine fuel systems. Chapter Three treats problems of chemical stabilization (chiefly, use of additives). Chapter Four reviews methods for determining the chemical composition of fuels. Chapter Five gives methods for estimating the tendency of fuels toward change. The work is intended for engineers and technicians involved in all phases of production and use of various types of motor fuels, as well as for scientists in petrochemical and refining work. Author (GRA)

N74-16871# Pittsburgh Univ., Pa. Space Research Coordination Center.

RESEARCH ON THE CHEMICAL REACTIONS OF METASTABLE ATMOSPHERIC GAS SPECIES Final Report, 1 May 1970 - 31 Aug. 1973

Frederick Kaufman 31 Aug. 1973 71 p refs

(Contract F19628-70-C-0255; AF Proj. 8658)

(AD-769958) Avail: NTIS CSCL 07/4

The report includes a general review of the present status of experimental as well as theoretical studies of the O - NO chemiluminescence and their correlation with the spectroscopy, fluorescence, and quantum chemsitry of NO2. It describes the measurement of the rate constant of the N(doublet D) - NO reaction by vacuum uv resonance line absorption, and infrared chemiluminescent emission measurements in the one to four micrometers wavelength range (a) of the O - NO recombination providing an absolute value of the effective second-order radiative rate constant; (b) of the O3 - NO reaction which is shown to produce vibrationally excited NO2 in large yield whose quenching rate constants by NO2, NO, O2, N2, and Ar are measured; and (c) of the H - NO2, H - O3, and N - O3 reactions in preliminary, mainly qualitative experiments. (Modified author abstract) GRA

N74-16872# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE HETEROGENEOUS-HOMOGENEOUS IGNITION OF A REACTING PLATE IN AN OXIDIZER FLOW

A. M. Grishin and A. Ya. Kuzin 6 Nov. 1973 12 p refs Transl. into ENGLISH from the publ. "Gorenie i Vzryv" USSR, 1972 p 38-43

(AD-769984; FTD-HT-23-620-74) Avail: NTIS CSCL 07/4

The translation concerns a general mathematical model of the heterogeneous-homogeneous ignition of a plate reacting with a flow containing an oxidizer component. GRA

N74-16873# Maryland Univ., College Park. Inst. of Molecular Physics.

THREE-PARTICLE COLLISION INTEGRALS FOR THERMAL CONDUCTIVITY, VISCOSITY AND SELF-DIFFUSION OF A GAS OF HARD SPHERICAL MOLECULES. PART 2: CALCULATIONS Final Report, 1 Sep. 1970 - 30 Jun. 1972

D. T. Gillespie and J. V. Sengers Nov. 1973 238 p refs

(Contract F40600-72-C-0002; F40600-73-C-0006)

(AD-770273; AEDC-TR-73-171) Avail: NTIS CSCL 07/4

In order to predict the first density corrections to the transport properties of gases, it is necessary to consider collision integrals that account for the effects of collisions among three molecules. For a gas of hard spherical molecules such three-particle collision integrals can be decomposed into collision integrals associated with sequences of one, two, three, and four successive collisions among three molecules. In the present technical report the authors calculate these three-particle collision integrals for the coefficients of thermal conductivity, viscosity, and self-diffusion. (Modified author abstract) GRA

N74-16874# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF A CATALYTIC AGENT ON THE CHARACTERISTICS OF THE COMBUSTION ZONE OF A CONDENSED SUBSTANCE

O. I. Leipunskii and A. A. Zenin 29 Oct. 1973 11 p refs Transl. into ENGLISH of the mono. "Gorenie i Vzryv," (USSR), 1972 p 74-77

(AD-770452; FTD-HT-23-628-74) Avail: NTIS CSCL 07/4

The purpose of the present work is to obtain data on the effect of a catalytic agent on the process of the thermal interaction of the combustion zones and to indicate the site of the effect of the combustion catalytic agent. For this, the temperature distribution in the combustion wave and the surface temperatures were determined on the burning surface of model mixtures with catalytic agents and without them. GRA

N74-16875# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF DISPERSION IN THE PROCESSES OF LINEAR PYROLYSIS AND COMBUSTION OF POLYMERS

A. S. Shteinberg, V. B. Ulybin, E. I. Dolgov, and G. B. Manelis 7 Nov. 1973 11 p refs Transl. into ENGLISH of the mono. "Gorenie i Vzryv," (USSR), 1972 p 124-127

(AD-770457; FTD-HT-23-640-74) Avail: NTIS CSCL 07/4

The translation concerns the experimental study of thermal decomposition linear pyrolysis and combustion under model conditions of samples of linear and cross-linked polymethyl methacrylates. Cross-linking is accomplished by the introduction of 2 and 10% triethylene glycol dimethacrylate. GRA

N74-16876# Hughes Research Labs., Malibu, Calif. Exploratory Studies Dept.

CHEMISTRY OF PHOTOPOLYMER LIGHT SENSITIVE SYSTEMS RELEVANT TO RADAR AND OTHER DISPLAYS Final Report

J. David Margerum Jul. 1973 69 p refs

(Contract F44620-68-C-0043; AF Proj. 9536)

(AD-770068; AFOSR-73-1365TR) Avail: NTIS CSCL 07/5

Investigations are reported on the inhibition, initiation and propagation of dye-sensitized polymerization reactions related to rapid access recording processes. Four interrelated areas were studied: (1) the photochemical formation of aci-nitro intermediates and their reactions as inhibitors and reducing agents; (2) the reactivity of substituted benzenesulfinic acid salts as photopolymerization catalysts; (3) the effects of monomer structure and reaction conditions on the rate and character of photopolymer image formation; (4) the effects of amorphous dry films on dye-sensitized photopolymer processes. (Modified author abstract) GRA

N74-16877# Office of Naval Research, London (England).

A SURVEY OF ZIRCONIA SOLID-ELECTROLYTE TECHNOLOGY

David M. Mason 17 Sep. 1973 15 p refs

(AD-770819; ORNL-R-23-73) Avail: NTIS CSCL 07/4

A brief survey is made of the practical electrochemical applications of zirconia stabilized into a cubic fluorite lattice employing an alkaline or rare-earth oxide additive. Stabilized zirconia has a high oxygen-ion conductivity and thus gaseous compounds containing oxygen can be electrochemically reduced forming oxygen ion at the cathode. A history of the development leading to the practical use of zirconia electrolytes in engineering devices is described including a recent proposition that it be used as a means of removing from combustion gases NO and NO2, (NOx), the species responsible for photochemical smog. Also the possibility of employing zirconia for analyzing NOx as

well as other species in gaseous mixtures is suggested.
Author (GRA)

N74-16878# Florida Univ., Gainesville. Dept. of Chemistry.
TRACE SPECTROMETRIC FLAME ANALYSIS AND GAS CHROMATOGRAPHIC DETECTORS RELATED TO JET ENGINE OIL ANALYSIS AND GAS DETECTION Final Report, 1 Nov. 1969 - 31 Aug. 1973
James D. Winefordner 1968 15 p
(Grant AF-AFOSR-1880-70)
(AD-769298/1GA; AFOSR-73-1968TR) Avail: NTIS CSCL 07/3

A summary of research is presented which includes: fundamental, instrumental and applied studies of atomic and molecular emission, atomic absorption, and atomic and molecular fluorescence of gases and of development of gas chromatographic detectors. Special emphasis has been given to rapid simultaneous and rapid sequential multielement analysis of several elements or species. A list of publications is included. (Modified author abstract) GRA

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-16879 British Broadcasting Corp., Kingswood (England). Research Dept.
AN EXPERIMENTAL INVESTIGATION OF TEST-NOISE SIGNALS FOR THE MEASUREMENT OF NON-LINEAR DISTORTION OF SOUND SIGNALS
R. A. Belcher Jan. 1974 17 p refs
(BBC-RD-1974/2) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Investigations into the correlation between objective measurements of distortion and subjective assessments of program impairment, using circuits where non-linearity increases with program signal level are described. A proposal is given for a method of distortion measurement which uses a test signal formed from pseudo-random noise. This type of measurement, referred to as a noise-separation test, gives better correlation with subjective assessments than the total harmonic distortion test used at present. Author

N74-16880 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL SOUND SIGNALS: BIT-RATE REDUCTION USING AN EXPERIMENTAL DIGITAL COMPANDOR
D. W. Osborne and M. G. Croll Dec. 1973 15 p refs
(BBC-RD-1973/41) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A previous investigation, using a simulation technique, indicated that considerable bit-rate reduction for the transmission of pulse-code modulated high-quality sound signals should be possible with a novel form of digital companding using a near-instantaneous technique. A description is given of the design principles of an experimental model of a near-instantaneous digital compandor, which has been constructed. Subjective tests with this equipment confirm that the bit rate per channel can be reduced from 416 kb/s, required for the linearly-coded system now in service in the BBC, to about 320 kb/s, without significant impairment of program quality. Author

N74-16881 New York Univ., N.Y.
TRANSIENT RESPONSE OF A TRACKING SYSTEM TO A SIGNAL WITH GAUSSIAN NOISE Ph.D. Thesis
Arthur Mayer 1973 158 p
Avail: Univ. Microfilms Order No. 73-28560

The transient response of a linear tracking system to a signal which includes Gaussian noise is described through the cumulants of a joint distribution of state variables. In general, the rate of change of the mean is proportional to the time-dependent expected value (with respect to the output distribution) of the difference of the two transition probability functions. The response of the mean to a step change of the input message is well approximated by a damped exponential function of time, and a formula is given for the time constant. Considering the steady-state variance and the response time of the mean for white input noise: their product is simply proportional to the noise intensity, and their quotient is independent of the noise. Dissert. Abstr.

N74-16882 British Broadcasting Corp., Kingswood (England). Engineering Div.
COMPUTER PREDICTION OF UHF BROADCAST SERVICE AREAS
J. H. Causebrook Jan. 1974 19 p refs
(BBC-RD-1974/4; RA-125) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A computer program was written to predict the service area of relay stations using data derived from maps. An outline is given of the methods employed to achieve this aim. Details are given of the required input and the form of output. Author

N74-16883*# Southeastern Massachusetts Univ., North Dartmouth.
LOW DATA RATE DIGITAL SPACE COMMUNICATIONS Final Report
Chi Hau Chen 27 Nov. 1973 78 p refs
(Grant NGR-22-031-002)
(NASA-CR-132925) Avail: NTIS HC $6.00 CSCL 17B

The low available transmitter power and the large frequency uncertainty constrain the data rate to be low. An all-digital communication receiver is proposed, and its feasibility is established. Although coherent systems should be used whenever practical, the noncoherent MFSK system is more suitable for very low data rates. The effect of Rician fading on the performance of MFSK receiver is studied. Fading characteristics of the Venus channel are examined based on the exponential model and available experimental data on the Venus atmosphere. Because of the requirement of high communication efficiency, three codes are evaluated and compared. The rapidly varying phase error at low data rate has great effects on the tracking loop behaviors which are examined by extensive computer study of the phase plane trajectories. Author

N74-16884*# Magnavox Research Labs., Torrance, Calif.
ADVANCED TRACKING AND DATA RELAY EXPERIMENTS STUDY: MULTIMODE TRANSPONDER EXPERIMENT ANALYSIS PROCEDURE Final Report, Sep. 1972 - Sep. 1973
R. S. Cnossen and J. Moses 15 Sep. 1973 13 p
(Contract NAS5-21824)
(NASA-CR-132913; R-4742) Avail: NTIS HC $3.00 CSCL 17B

Plans and implementation concepts were developed for utilizing a multimode transponder mounted in an aircraft working either through a spacecraft or directly with a ground station. The purpose would be to determine the best modulation and encoding techniques for combating RFI and multipath propagation and to determine the characteristics of VHF and UHF RFI in discreet bands. The experiments would also determine the feasibility and accuracy of range and range rate measurements with the various modulation and encoding techniques. Author

N74-16885*# Computer Sciences Corp., Falls Church, Va.
FREQUENCY MODULATION TELEVISION ANALYSIS: THRESHOLD IMPULSE ANALYSIS Final Report, Sep. 1972 - Nov. 1973
William H. Hodge 26 Nov. 1973 239 p refs
(Contract NAS5-21872)
(NASA-CR-132906; Rept-3007-1) Avail: NTIS HC $14.00 CSCL 17B

A computer program is developed to calculate the FM threshold impulse rates as a function of the carrier-to-noise ratio for a specified FM system. The system parameters and a vector of 1024 integers, representing the probability density of the modulating voltage, are required as input parameters. The computer program is utilized to calculate threshold impulse rates for twenty-four sets of measured probability data supplied by NASA and for sinusoidal and Gaussian modulating waveforms. As a result of the analysis several conclusions are drawn: (1)

The use of preemphasis in an FM television system improves the threshold by reducing the impulse rate. (2) Sinusoidal modulation produces a total impulse rate which is a practical upper bound for the impulse rates of TV signals providing the same peak deviations. (3) As the moment of the FM spectrum about the center frequency of the predetection filter increases, the impulse rate tends to increase. (4) A spectrum having an expected frequency above (below) the center frequency of the predetection filter produces a higher negative (positive) than positive (negative) impulse rate. Author

N74-16886# Australian Post Office Research Labs., Melbourne.
A DELTA CODED FREQUENCY MODULATED RURAL SUBSCRIBERS' RADIO SYSTEM
R. H. Blair Aug. 1973 34 p refs
(Rept-6744) Avail: NTIS HC $3.75

The development and testing of a single-channel subscribers' radio system using frequency modulation with the facility of operating in either an analog transmission mode or a binary digital mode are examined, employing delta-coding of the speech waveform. The more unusual aspects of the design for digital operation are described. Results of the comparative performance parameters of digital and analog working are also presented. Author

N74-16887*# Magnavox Research Labs., Torrance, Calif.
ADVANCED TRACKING AND DATA RELAY EXPERIMENTS STUDY: MULTIMODE TRANSPONDER EXPERIMENT EQUIPMENT Final Report, Sep. 1972 - Sep. 1973
R. S. Cnossen 15 Sep. 1973 29 p refs
(Contract NAS5-21824)
(NASA-CR-132930; R-4741) Avail: NTIS HC $4.50

Plans and implementation concepts were developed for a series of experiments utilizing a Multimode Transponder mounted in an aircraft working either through a spacecraft or directly with a ground station which would simulate a TDRSS user working through the TDRSS. The purpose of the experiments is to determine the best modulation and encoding techniques for combating RFI in discreet bands. The experiments also determine the feasibility and accuracy of range and range rate measurements with the various modulation and encoding techniques. An analysis of the Multimode Transponder and ground support equipment is presented, and the additional equipment required to perform the experiments described above is determined. Author

N74-16888*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TECHNOLOGY REQUIREMENTS FOR POST-1985 COMMUNICATIONS SATELLITES Summary Report
J. E. Burtt, C. R. Moe, R. V. Elms, L. A. DeLateur, W. C. Sedlacek, and G. G. Younger Sep. 1973 28 p
(Contract NAS2-7073)
(NASA-CR-114679) Avail: NTIS HC $4.50 CSCL 22B

The technical and functional requirements for commercial communication satellites are discussed. The need for providing quality service at an acceptable cost is emphasized. Specialized services are postulated in a needs model which forecasts future demands. This needs model is based upon 322 separately identified needs for long distance communication. It is shown that the 1985 demand for satellite communication service for a domestic region such as the United States, and surrounding sea and air lanes, may require on the order of 100,000 MHz of bandwith. This level of demand can be met by means of the presently allocated bandwidths and developing some key technologies. Suggested improvements include: (1) improving antennas so that high speed switching will be possible; (2) development of solid state transponders for 12 GHz and possibly higher frequencies; (3) development of switched or steered beam antennas with 10 db or higher gain for aircraft; and (4) continued development of improved video channel compression techniques and hardware. S.K.W.

N74-16889*# Techtran Corp., Glen Burnie, Md.
LUNAR RADIO EMISSION IN THE 1.25 TO 2.5 CM BAND
V. M. Plechkov Washington NASA Feb. 1974 6 p refs Transl. into ENGLISH from the publ. "Fizika Luny i Planet" Moscow, Nauka, 1972 p 104-106
(Contract NASw-2485)
(NASA-TT-F-14755) Avail: NTIS HC $4.00

Precision and relative measurements of the phase curve of the average effective lunar temperature were conducted on wavelengths of 1.25, 1.45, 1.60, 1.80, 2.0 and 2.5 cm to determine whether there is high absorption in the lunar surface of radio waves close to wavelength = 1.6 cm. The electromagnetic absorption coefficient and loss tangent in the lunar soil are found from the relative constant component and amplitude of the first harmonic of the temperature of the moon. The findings are preliminary and required further experimental check and simulation of electrical properties of lunar soil in artificial dielectrics. Author

N74-16890*# Techtran Corp., Glen Burnie, Md.
ANALYSIS OF RADIO WAVE PROPAGATION IN THE VENUSIAN ATMOSPHERE
O. I. Yakovlev Washington NASA Feb. 1974 8 p refs Transl. into ENGLISH from the publ. "Fizika Luny i Planet" Moscow, Nuka, 1972 p 372-374
(Contract NASw-2485)
(NASA-TT-F-14756) Avail: NTIS HC $4.00

Ultrashort-wave propagation in the Venusian atmosphere is investigated in two models as a function of the vertical distribution of the electromagnetic refractive index. The Venusian atmosphere is found to be turbulent to an altitude of about 40 km, radio wave attenuation in the Venusian atmosphere is caused mainly by molecular absorption, and refractive effects are strong in the atmosphere of Venus. Author

N74-16891*# Scientific Translation Service, Santa Barbara, Calif.
RECOVERY OF ANALOG SIGNAL SHAPES FROM DISCRETE READINGS
V. P. Yevdokimov and L. I. Kolesnikov Washington NASA Feb. 1974 18 p refs Transl. into ENGLISH of "Vosstanovleniye Formy Analogovykh Signalov po Diskretnym Otschetan", Acad. of Sci. USSR, Inst. of Space Res., Moscow, report PR-134, 1973 23 p
(Contract NASw-2483)
(NASA-TT-F-15286; PR-134) Avail: NTIS HC $4.00

Linear filters with finite memory of increasing complexity and the optimal linear filter, which is physically unrealizable, are considered. Calculations of the recovery errors are carried out for various reading frequencies and various recovery functions. Author

N74-16892*# Operations Research, Inc., Silver Spring, Md.
STUDY OF DATA COLLECTION PLATFORM CONCEPTS: DATA COLLECTION SYSTEM USER REQUIREMENTS Final Report
Apr. 1973 190 p refs
(Contract NAS5-21632)
(NASA-CR-132907; TR-769) Avail: NTIS HC $12.50 CSCL 09F

The overall purpose of the survey was to provide real world data on user requirements. The intent was to assess data collection system user requirements by questioning actual potential users rather than speculating on requirements. The end results of the survey are baseline requirements models for both a data collection platform and a data collection system. These models were derived from the survey results. The real value of these models lies in the fact that they are based on actual user requirements as delineated in the survey questionnaires. Some users desire data collection platforms of small size and light weight. These sizes and weights are beyond the present state of the art. Also, the survey provided a wealth of information on the nature and constituency of the data collection user community as well as information on user applications for data collection systems. Finally, the data sheds light on the generalized platform concept. That is, the diversity of user requirements shown in the data indicates the difficulty that can be anticipated in attempting to implement such a concept. Author

N74-16893*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW METHOD FOR SATELLITE ORBIT DETERMINATION USING AN OPERATIONAL WORLDWIDE TRANSPONDER

NETWORK
Joe J. Lynn (Old Dominion Systems, Inc.), Paul E. Schmid, and Roy E. Anderson (GE, Schenectady, N.Y.) Jan. 1974 21 p refs Presented at the American Geophysical Union Fall Annual Meeting, San Francisco, 10-13 Dec. 1973
(NASA-TM-X-70587; X-591-74-2) Avail: NTIS HC $4.25 CSCL 22C

The method utilizes computer programs developed for the forthcoming ATS-F/NIMBUS-F tracking and data relay experiment where the basic tracking measurements are multiple path round-trip propagation times and rates. This method of orbit computation has recently been successfully evaluated by tracking a geostationary satellite (ATS-3) using an existing VHF (150 MHz) network of automatic transponders. A master station sequentially interrogates each transponder via the ATS-3. The master site is located at Schenectady, N. Y. and four automatic transponders were located at Shannon, Reykajavik, Buenos Aires, and Seattle respectively. Data at hourly intervals were collected during a 24 hour period on April 18-19, 1973. After correcting this data for known systematic errors it was provided as input to an orbit determination program where all satellite motions during signal propagation are rigorously accounted for. The resulting estimated ATS-3 orbit yielded observational residuals on the order of 100 meters. By using more than one satellite the present scheme is further capable of accurately locating several stationary or mobile terminals as part of the overall orbital solution. Author

N74-16894# Australian Post Office Research Labs., Melbourne.
A STUDY OF THE CORROSION PLUG 603 AND SOCKET 610
G. Flatau, K. Mottram, and K. Keir Mar. 1973 31 p ref
(Rept-6781) Avail: NTIS HC $4.75

Over a number of years the plug 603 and the socket 610 associated with the 800 type telephone have resulted in service problems due to corrosion. A study of service failure did not indicate a simple pattern of failure. Experiments demonstrated that failure was occurring by increased contact resistance between the springs and pins. By modifications to the present design, the service life can be markedly increased. The general design of the present plug and socket is considered unsatisfactory, and complete redesign is considered essential. Author

N74-16895# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
GENERALIZED MULTIMODE RADAR SYSTEM SIMULATION MODEL. VOLUME 2, PART 1: COMPUTER PROGRAM DOCUMENTATION Final Report
Robert J. Hancock Aug. 1973 259 p refs
(Contract F30602-72-C-0393)
(AD-769875; RADC-TR-73-273-Vol-2-Pt-1) Avail: NTIS CSCL 17/9

The volume of the final technical report contains the descriptions of the computer programs and subprograms which constitute the Multimode Radar System Simulation Model. GRA

N74-16896# Los Alamos Scientific Lab., N.Mex.
DETERMINATION OF THE EMP ENHANCEMENT FACTOR
C. U. Benton, A. N. Phillips, R. W. Buchanan, and H. M. Fowles Jul. 1973 11 p refs
(Contract W-7405-eng-36)
(LA-5257) Avail: NTIS HC $4.00

EMP signals recorded aboard a C-135 aircraft are discussed with respect to the difference in amplitude and phase characteristics from that of a free-space signal. The enhancement factor is defined as the ratio of the normalized amplitude of the aircraft signal to the normalized amplitude of close-in sensors for a 2 MV pulsed antenna system. Three different close-in sensors were used to measure fields in excess of 10 kV/m. The radiation pattern was mapped in azimuth and elevation by the aircraft and the close-in sensors. The enhancement factor and the time rate of change of the EMP signal is seen to vary significantly with aircraft attitude and position. Author (NSA)

N74-16897# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
SIMULATION OF THE PROCESSING OF SCIENTIFIC TELEMETRY DATA OF TIROS N [SIMULATION DU TRAITEMENT DE LA TEL EMESURE SCIENTIFIQUE TIROS N]
Andre Cariou 1973 17 p In FRENCH Presented at the Intern. Seminar on Simulation and Space. Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.00

The feasibility of a processing system for the Tiros N satellite telemetry data, and the consequences for the global conception of the system have been studied by means of simulation. This simulation reproduces a complete localization system of platforms by the satellite, including mobile platforms on the earth's surface, a network of ground stations, a satellite, and a data processing center. It is possible to enter the performances of the different equipments, and to obtain estimated global performance by the quality of the localization. ESRO

N74-16898# Technical Univ. of Denmark, Lyngby.
COMPUTATION OF SPACECRAFT ANTENNA RADIATION PATTERNS
N. C. Albertsen, J. E. Hansen, and E. N. EilskovJensen Paris ESRO Sep. 1973 101 p refs
(Contract ESTEC-1340/71)
(ESRO-CR-207) Avail: NTIS HC $8.25

A program is described for computing the radiation pattern of VHF antennas mounted on complex satellite bodies equipped with experiment-carrying booms and solar cell panels. It is an extended and improved version of a previously reported program. The numerical method used combines magnetic and electrical field integral equations, which are solved by the method of moments. A number of test runs were compared with experimental patterns derived from measurements made on a circular cylindrical satellite model. It is concluded that the accuracy achieved is within + or - 1 db for cases involving booms and a few decibels for cases involving solar cell panels. Two actual satellite structures, those of ESRO 4 and ANS, were investigated with the aid of the program. Author (ESRO)

N74-16899# AEG-Telefunken, Ulm (West Germany).
TRANSPONDER RECEIVER STUDY FOR THE NEMD PROJECT SPACECRAFT. VOLUME 1: TECHNICAL INVESTIGATIONS Final Report
G. B. Go Paris ESRO Sep. 1973 105 p refs
(Contract ESTEC-1783/72)
(ESRO-CR-210) Avail: NTIS HC $8.25

The use of the Helios receiver and a solid-state S-band transmitter is considered. The areas of compatibility of these with each other and with the ground-station network and the s/c data-handling system were investigated. The link feasibility was calculated. Weight, power consumption and reliability were estimated for different switching and selection configurations. It is concluded that the chosen transmitter/receiver configuration was capable of meeting the known system requirements with appropriate modifications. Author (ESRO)

N74-16900# Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).
SIDE-LOOKING RADAR SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH-RESOURCES SURVEYS. BASIC PHYSICS AND TECHNOLOGY
R. A. Deane Paris ESRO Apr. 1973 131 p refs
(Contract ESTEC-1537/71)
(ESRO-CR-136) Avail: NTIS HC $9.75

The basic physics and technology of real and synthetic aperture side-looking radar systems are described with particular emphasis on their application to earth resources surveys. The installation and operation of the radar in aircraft and satellites is considered for mapping both static terrain and moving vehicles. A brief introduction is included on atmospheric influences and terrain reflections at microwave frequencies. ESRO

N74-16901# Birmingham Univ. (England). Dept. of Electronic and Electrical Engineering.
MULTIPLE-BEAM ANTENNAS: OFFSET REFLECTORS WITH OFFSET FEEDS Final Report
A. W. Rudge and M. Shirazi 25 Jul. 1973 52 p refs
(Contract ESTEC-1725/72-PP)
(ESRO-CR(P)-316) Avail: NTIS HC $5.75

The development and programming of a mathematical model of the offset parabolic reflector antenna is described. The model provides predictions of the principally polarized and cross-polarized radiation from such antennas when the primary-feed is located in the vicinity of the reflector focus. Since the model accommodates small offsets in the primary-feed location, relative to the reflector focus, it can be usefully employed in the study and design of reflector antennas with multiple-element primary-feeds. Predictions obtained from the model are compared with the data obtained from a brief experimental program, and a satisfactory correlation is observed. Author (ESRO)

N74-16902# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany). Dept. of Telecommunications.
FLIGHT MEASUREMENTS IN NORTH ATLANTIC AND AFRICAN REGIONS OF MARGINAL SATELLITE VISIBILITY
H. J. Albrecht, M. Piening, and K. Rosenbach Oct. 1973 27 p refs Repr. from Proc. 16th Symp. on Tactical Satellite Commun. (The Hague) 19 Sep. 1973 p 1-23
(Rept-3-73) Avail: NTIS HC $4.50

Field strength fluctuations in satellite communications in regions of marginal terrestrial illumination are discussed. Investigations were carried out with a special airborne receiver by means of long-distance test flights in polar and equatorial zones of enhanced intensity of ionospheric irregularities. It was found that, for scintillation maxima, there was an apparent persistance of three days in the North Atlantic and 24 hours in the African equatorial region. The possibility of synoptically recognising and short-term forecasting disturbances of satellite communications due to ionospheric scintillation is also discussed. ESRO

N74-16903# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
FURTHER STUDIES ON SPEECH INTELLIGIBILITY WITH FREQUENCY-MODULATION COMMUNICATION SYSTEMS UNDER FADING CONDITIONS
D. E. Marquart Oct. 1973 14 p refs Repr. from 16th Symp. on Tactical Satellite Commun. (The Hague) 19 Sep. 1973 p 45-54
(Rept-5-73) Avail: NTIS HC $4.00

The applicability of a method for computing articulation scores to be expected with FM communication systems under arbitrary fading conditions to an experimental helicopter-satellite link is tested. A description of the experiment with respect to intelligibility measurements is followed by the analysis of calculated and measured results which are in good agreement. A discussion of some additional results derived during performance and analysis of experiments is included. ESRO

N74-16904# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany). Dept. of Telecommunications.
STATISTICAL ANALYSIS OF SIGNAL FLUCTUATIONS ON A GROUND-MOBILE SATELLITE COMMUNICATION LINK
R. Menzel Oct. 1973 52 p refs Repr. from 16th Symp. on Tactical Satellite Commun. (The Hague) 19 Sep. 1973 p 57-104
(Rept-6-73) Avail: NTIS HC $5.75

Propagation phenomena in satellite communications to ground-mobile terminals are examined. Short term variations of the signal in various types of terrain are determined by the use of such statistical means as level-crossing rates, average duration of fades and the power spectrum. A technique for reducing the deep fading travelling through a standing wave pattern was tested and was found to be suitable. ESRO

N74-16905# Naval Postgraduate School, Monterey, Calif.
A PRACTICAL VOICEBAND TELEVISION SYSTEM DESIGN M.S. Thesis
F. F. Mackenzie Sep. 1973 81 p refs
(AD-769690) Avail: NTIS CSCL 17/2

A need exists to send television on channels of limited bandwidth, particularly 3 kHz. Successive images must have adequate picture content yet be frequent enough to give the appearance of motion. A new coding scheme was devised to meet this need for video data compression. A 2400 band system was designed and built. A hierarchy of transmission modes is used which allows the transmitter to choose the most efficient of 3 modes to send a line. One mode uses a variable-length Instantaneously Uniquely Decipherable code optimized for the statistics of some typical expected pictures. The picture size is 64 by 64 elements, each with 4 luminance levels. The transmitter has a stored line (129 bits) and a two-dimension model to predict the following line. After comparing the prediction to a fresh line the deviations from the prediction are sent. Then the receiver uses the same model to update a similar stored line to be displayed. Frame duration can range from .13 to 3.54 seconds as determined by the actual picture. Author (GRA)

N74-16906# Army Limited War Lab., Aberdeen Proving Ground, Md.
EVALUATION OF VOICE RECORDERS FOR AIRCRAFT
Stanley D. Peirce Oct. 1973 11 p
(AD-770517; LWL-TR-74-04) Avail: NTIS CSCL 14/3

The U.S. Army Land Warfare Laboratory evaluated existing tape recorder/reproducers for use as voice monitors in Army surveillance and observation aircraft. It was concluded that none of the tested recorders are capable of meeting the DA Approved Performance Characteristics for Recorder, Voice for Surveillance and Observation Aircraft. However, development of a suitable recorder is well within the state-of-the-art. Author (GRA)

N74-16907# General Electric Co., Santa Barbara, Calif. TEMPO.
WEPH V CODE MODIFICATIONS FOR HF PROPAGATION AND SYSTEM PERFORMANCE MODELING
Royden R. Rutherford 19 Oct. 1973 115 p refs
(Contract DNA001-72-C-0180)
(AD-770053; GE73TMP-20; DNA-3153T) Avail: NTIS CSCL 20/14

The report describes modifications to the WEPH V code that permit the use of the code for evaluation of HF propagation and system performance in nuclear-disturbed environments. The propagation and system models are an extension of those presented in the DNA HF Communication Handbook (DASA 1955-1 and -2). The principal degradation effect modeled is D-region absorption. While changes in sky-wave geometry due to the disturbed environment are not determined, modifications to F-region critical frequencies at selected points are evaluated from approximate models. The modified WEPH V code is intended for use in rapid evaluation of the effects of propagation, system, and environment parameters on system performance, and to identify situations where analysis with detailed ray tracing codes such as the NUCOM code (DASA 2035) is required.
Author (GRA)

N74-16908# Radiation, Inc., Melbourne, Fla.
COMMUNICATIONS PHASED-ARRAY ANTENNA MODULE Final Report, 24 Mar. 1972 - 23 Mar. 1973
M. Wayne Matchett, Douglas E. Heckaman, and Jerry B. Schappacher Sep. 1973 136 p refs
(Contract F30602-72-C-0260; AF Proj. 4519)
(AD-769887; RADC-TR-73-289) Avail: NTIS CSCL 17/2

A study and investigation was conducted to develop a low-cost receive/transmit module for use in communications phased-array antennas. Design approaches covering the 1 to 8 GHz range were investigated. A module design was recommended for C-band, and key circuits were implemented using hybrid integrated circuit technology. The recommended approach is an all-RF (no conversions to IF) module incorporating a transistor low-noise amplifier in the receive channel and a phase-lock loop stabilized injection-locked oscillator as the power amplifier in the transmit channel. High-Q microstrip design techniques are used to achieve low-loss duplexer filters. Three-bit digital phase shifters are used in each channel to achieve independent transmit and receive beam steering. Author (GRA)

N74-16909# Stanford Univ., Calif. Electronics Labs.
A MARTINGALE APPROACH TO MODELING, ESTIMATION AND DETECTION OF JUMP PROCESSES
Adrian Segall Aug. 1973 181 p refs
(Contracts N00014-67-A-0112-0044; F44620-69-C-0101; AF Proj. 7050)
(AD-770554; SU-SEL-73-042; TR-7050-21) Avail: NTIS CSCL 09/4

The study contains a systematic approach to problems of modeling, nonlinear estimation and detection of signals in jump-type observations, namely processes whose paths are discontinuous. It is shown that modern martingale theory provides a powerful tool for attacking these problems in a unified and rigorous manner. A general model for describing signals in jump observations is presented. It is shown that a martingale model includes all the previously proposed ones and also covers the difficult case of past-dependent signals that arises in feedback communication and control problems. (Modified author abstract) GRA

N74-16910# Center for Communications Research, Inc., Rochester, N.Y.
A STUDY OF THE CAPABILITY OF GRAMMATICAL ANALYSIS TO IMPROVE ACCURACY IN CONTINUOUS SPEECH RECOGNITION FOR COMMAND AND CONTROL Interim Scientific Report
Wilbur D. Larkin and William B. Newcomb 30 Jun. 1973 54 p refs
(Contract F44620-71-C-0090; AF Proj. 9769)
(AD-770031; AFOSR-73-1973TR) Avail: NTIS CSCL 17/2

Effort has been concentrated on the development of the major components of the complete speech understanding system. The acoustic analysis and segmentation procedures have been run on a modest sample of speech. The segment classification program has been run. The lexical processing has been run extensively with errorful alphabetic strings substituting for phonetic strings. The syntax model is complete and a beginning has been made on the semantic model necessary for processing inputs over limited subject matter. A major effort was expended in integrating the various components which have individually reached maturity. The analysis indicates the sensitivity of the total solution to the segment classification and lexical processing. (Modified author abstract) GRA

N74-16911# Michigan Univ., Ann Arbor. Radiation Lab.
CW MEASUREMENTS OF RIGHT CIRCULAR CONES
Eugene F. Knott and Thomas B. A. Senior Apr. 1973 178 p
(Contract F19628-73-C-0126; AF Proj. 5635)
(AD-769976; UMICH-011758-1-T; AFCRL-TR-73-0269; SR-1) Avail: NTIS CSCL 17/9

The measured backscattering characteristics of two metallic right circular cones, with and without absorbing pads on their bases, are shown in 328 patterns. The absorber pads were used to reduce second order diffraction across the base of the cones. Measurements were carried out at closely spaced frequencies from 8.0 to 12.0 GHz, for both horizontal and vertical polarizations, using a CW cancellation method. Author (GRA)

N74-16912# Washington Univ., Seattle. Dept. of Electrical Engineering.
PROPAGATION AND RECEPTION OF PARTIALLY COHERENT WAVES IN RANDOM MEDIA Final Report, 15 Dec. 1971 - 30 Jun. 1973
Akira Ishimaru Jul. 1973 12 p refs
(Contract F19628-72-C-0063; AF Proj. 8682)
(AD-769974; AFCRL-TR-73-0504) Avail: NTIS CSCL 20/14

The final report gives a summary of all the work completed and under way under this contract covering the period from December 1971 to June 1973. The work covers a broad spectrum including remote probing of atmospheric turbulence and wind velocity, wave fluctuations in localized turbulence, multiple scattering effects in rain, and wide band wave propagation in random particles and turbulence. (Modified author abstract) GRA

N74-16913# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
THE THEORY OF SIGNAL DETECTABILITY: CYCLO-STATIONARY PROCESSES IN ADDITIVE NOISE
Joseph R. Lapointe, Jr. Oct. 1973 123 p refs
(Contract N00014-67-A-0181-0032)
(AD-769230; TR-224) Avail: NTIS CSCL 09/4

Cyclo-stationary (CS) processes are those nonstationary processes that appear to be stationary when observed at integral multiples of a basic interval. Wide Sense Cyclo-stationary (WSCS) processes possess autocorrelation functions and autocorrelation matrices with a cyclic structure for continuous and discrete time respectively. Discrete time WSCS processes normally arise from sampling continuous time WSCS processes. Other sampling schemes such as multiplexing samples from different stationary random processes or multiplexing samples from the sensors of an array also generate random processes with a cyclic structure in the autocorrelation matrix. The optimum detector for the fixed time forced choice detection of discrete time WSCS processes in additive noise is designed according to the likelihood ratio. A suboptimum detector is also presented and is the low input signal-to-noise ratio form of the optimum detector. (Modified author abstract) GRA

N74-16914# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
ON THE N EQUAL AMPLITUDE SINUSOIDAL INTERMODULATION PROBLEM Research Report, Nov. 1972 - Mar. 1973
Rodney C. Gibson 6 Apr. 1973 11 p refs
(Contract F04701-72-C-0073)
(AD-770066; TR-0073(3420-01)-1; SAMSO-TR-73-268) Avail: NTIS CSCL 17/2

Determination of the intermodulation power levels in the case of soft-limiting multiple-access repeaters is often critical to system design. An approximate solution to the biased nu th law problem is derived that simplifies the determination of the critical intermodulation power resulting from N carriers. Experimental measurements of a diode simulator are compared with the corresponding approximate analytical results. Finally, measurements with an amplifier operating in the VHF/UHF spectrum are compared with calculations from a biased nu th law model. (Modified author abstract) GRA

N74-16915# Lincoln Lab., Mass. Inst. of Tech., Lexington.
BACKSCATTER CROSS SECTION OF A PARABOLOIDAL ANTENNA
Peter S. S. Kao 30 Aug. 1973 80 p refs
(Contract F19628-73-C-0002; AF Proj. 1228)
(AD-770012; TN-1973-39; ESD-TR-73-239) Avail: NTIS CSCL 17/9

Theoretical calculations agree well with experimental measurements of high-frequency scattering by a paraboloidal reflector. Experimental measurements were conducted on 18-inch-diameter, waveguide-fed and 24-inch-diameter, cross dipole-fed, paraboloidal antennas over a range of frequencies and aspect angles with various combinations of transmit/receive polarizations and feed dipole orientations. (1) Simple mathematical formulas were developed for nose-on radar cross section (RCS) as a function of load impedance and transmit/receive polarization. (2) Possible out-of-band RCS reduction methods were investigated and models made for testing. (3) RCS phase information on the antennas was also obtained as approximated by an empirical expression over the frequencies of interest. Author (GRA)

N74-16916# Hydroacoustics, Inc., Rochester, N.Y.
MATHEMATICAL MODELING OF FLEXURAL DISK TRANSDUCERS FOR ARRAYS
E. M. Cliffel, Jr. and R. F. DeLaCroix 28 Sep. 1973 42 p refs
(Contract N00024-72-C-1295)
(AD-770168; HA-121-73) Avail: NTIS CSCL 17/1

The HINGE-DISK program was used to develop a multiport flexibility model for a typical bilaminar flexural disk transducer. The dynamic performance of a single transducer and a line array of three modules (each module is 2 transducers assembled back to back) was predicted using this multiport flexibility model as a basic building block. The computer program ARRAY was developed as a special hybrid version of the DYANA program to perform the dynamic array analysis. Three different two port models were developed as approximations to the multiport model. The predicted dynamic performance of single two port modules, and line arrays of two ports, were compared against the full multiport model results which served as the standard of comparison. GRA

N74-16917# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AN IMPLEMENTATION OF CONVENTIONAL METHODS OF

MEASURING THE AMPLITUDE AND PHASE OF BACKSCATTER FIELDS
Richard B. Mack, Alfred W. Wojcicki, and John J. Andriotakis
16 Jul. 1973 36 p refs
(AF Proj. 5635)
(AD-770015; AFCRL-IP-196; AFCRL-TR-73-0418) Avail: NTIS CSCL 20/14

The report describes an experimental equipment and procedure based on conventional methods in a form well-suited for laboratory measurements without expensive specialized components of the phase as well as amplitude of backscattered fields of smaller, resonant-region models on simulated free-space scattering ranges. Practical details that affect the ease of measurement and accuracy are emphasized. Simple methods of probing the incident fields over the model space are discussed, and sample results are presented. Author (GRA)

N74-16918# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering and Electrophysics.
APPLICATIONS OF INFORMATION AND SYSTEM THEORY TO AIR FORCE PROBLEMS IN COMMUNICATIONS AND DATA HANDLING Final Report, 1 Sep. 1972 - 31 Jul. 1973
J. K. Wolf 31 Jul. 1973 20 p refs
(Contract F44620-72-C-0085; AF Proj. 9749)
(AD-770042; AFOSR-73-1914TR) Avail: NTIS CSCL 09/4

The research was concerned with algebraic coding theory, the detection and estimation of signals in noise and fundamental problems in information theory. Specific topics include: the algebraic decoding of codes when the output of the channel contains more levels than the transmitted signals, the joint detection and estimation of signals in noise, the estimation of parameters of a recursive system which is an approximation to an unknown system, source coding for correlated information sources, the determination of the channel capacity region for a multiple input channel with correlated message sources with and without feedback and the amount of information required to specify one of K items from a list of N items. Author (GRA)

N74-16919# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
OPTIMUM AND ADAPTIVE ARRAY PROCESSING IN FREQUENCY-WAVENUMBER SPACE
Louis L. Scharf and David C. Farden 1973 44 p refs Presented at USAG/NUSC Workshop - Multidimensional Anal. of Acoustic Fields, Woods Hole, Mass., 9-12 Oct. 1972
(Contracts N00123-73-C-1375; N00014-67-A-0299-0019)
(AD-770186) Avail: NTIS CSCL 20/1

In the paper a frequency-domain adaptive array structure is derived that processes data in selected regions of frequency-wavenumber space to provide a minimum mean squared error estimate of a signal component of the observed acoustic field. New stochastic convergence results are presented, indicating that the covariance ergodicity conditions invoked by Parzen to ensure strong consistency of covariance estimates also ensure convergence of the stochastic approximation algorithm for the beamformer gains. These convergence results appear to be the most readily applicable results yet obtained for algorithms that must operate on correlated data. (Modified author abstract) GRA

N74-16920# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
CRYSTAL CONTROLLED L-BAND TELEMETRY TRANSMITTER Final Report
Louis Wunderlich Sep. 1973 58 p refs
(Grant DAAG39-72-C-0074)
(AD-770539) Avail: NTIS CSCL 09/6

The effort included development of an L-Band Telemetry Transmitter having approximately 150 mW output with an efficiency of 10 percent. The transmitter is designed to withstand firing from 105 mm and 155 mm artillery weapons. It operates at 1510 MHz and is crystal controlled to obtain a frequency stability of 0.002 percent. The unit is constructed using microstrip circuits using high dielectric constant ceramic substrates. (Modified author abstract) GRA

N74-16921# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
GENERALIZED MULTIMODE RADAR SYSTEM SIMULATION MODEL. VOLUME 1: TECHNICAL DESCRIPTION Final Report
Robert J. Hancock Aug. 1973 205 p refs
(Contract F30602-72-C-0393)
(AD-769874; RADC-TR-73-273-Vol-1) Avail: NTIS

The purpose was to develop a generalized multimode radar/target/clutter digital computer simulation model to aid RADC engineers in evaluating the target detection and tracking capability of radar systems in various environments and against different targets. The digital computer simulation model was implemented on the RADC HIS-645 digital computer system in FORTRAN IV language. GRA

N74-16922# Army Foreign Science and Technology Center, Charlottesville, Va.
REMOTE CONTROL SYSTEMS
V. A. Ilin 23 Oct. 1973 12 p refs Transl. into ENGLISH from E.I.K.A. Entsiklopediya Izmerenii, Kontrolya i Avtomatiz. (USSR), no. 10, 1968 p 29-32
(AD-770732; FSTC-HT-23-158-73) Avail: NTIS CSCL 17/2

A high-capacity remote control system is equivalent in its complexity and number of parts to a digital computer, but operates under more severe climatic conditions and frequently without duty personnel at the controlled object. This has a negative influence on its reliability and hinders reliable transmission of signals. As the information capacity and requirements for reliability increase, a tendency began to appear toward sporadic addressed transmission of digital binary codes with adaptation to the noise level in the communications channel. This increases the automatic nature of actions and allows the range of functions which can be performed to be expanded. Author GRA

N74-16983* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE TROPOSPHERIC CALIBRATION MODEL FOR MARINER MARS 1971
C. C. Chao *In its* Tracking System Analytic Calibration Activities for the Mariner Mars 1971 Mission 1 Mar. 1974 p 61-76 refs (For availability see N74-16979 08-11)
CSCL 17B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-16923 Stanford Univ., Calif.
COMPUTER IDENTIFICATION OF TEXTURED VISUAL SCENES Ph.D. Thesis
Ruzena Kucera Bajcsy 1973 165 p
Avail: Univ. Microfilms Order No. 73-30357

A computer analysis is presented of textured outdoor scenes involving grass, trees, water, and clouds. Descriptions of texture are formalized from natural language descriptions; local texture descriptors are obtained from the directional and non-directional components of the Fourier transform power spectrum. Analytic expressions are obtained for orientation, contrast, size, spacing, and in periodic cases, the locations of texture elements. These local descriptors are defined over windows of various sizes; the choice of sizes is made by a simple higher-level program. The process of region growing is represented by a sheaf-theoretical model which formalizes the operation of pasting local structure (over a window) into global structure (over a region). Programs were implemented which form regions of similar color and similar texture with respect to the local descriptors. Dissert. Abstr.

N74-16924# National Bureau of Standards, Washington, D.C. Systems and Software Div.
STATIC LANGUAGE ANALYSIS
Gordon Lyon Oct. 1973 25 p refs
(NBS-TN-797) Avail: SOD HC $0.50 as C13.46:797

Although many variants of programming languages exist, little information is available on how language features are actually used by programmers. Several data collection schemes are

discussed, each would provide empirical data on language use. Some internal details are given for analyzers for FORTRAN and COBOL. In addition, a suggestion is made for a special systems option which would allow a compiler to continuously record source statement characteristics of programs given to it. Author

N74-16925# Advisory Group for Aerospace Research and Development, Paris (France).
NEW DEVELOPMENTS IN STORAGE, RETRIEVAL AND DISSEMINATION OF AEROSPACE INFORMATION
Dec. 1973 107 p refs Presented at 26th Meeting of the AGARD Tech. Inform. Panel, London, 2-3 Oct. 1973
(AGARD-CP-136) Avail: NTIS HC $8.50

The state of the art in computerized processing of aerospace information is examined, emphasizing mechanization developments with both large and minicomputers and in reprographics. For individual titles, see N74-16926 through N74-16939.

N74-16926 Kingston-Upon-Hull City Libraries, Hull (England).
A COMPUTER PRODUCED KEYWORD INDEXING SYSTEM FOR TECHNICAL REPORTS IN THE LIBRARY OF THE AIRCRAFT RESEARCH ASSOCIATION LIMITED
Christopher Barnett *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 7 p refs (For availability see N74-16925 08-08)

A computer produced cataloguing and subject indexing system for report material acquired by the ARA library is described. Keyword listings with indexes under authors' and originators' references are used to produce a monthly accession list and monthly and annual cumulating catalogues. The keywords are supplied manually using a specially constructed thesaurus.
Author

N74-16927 Defence Scientific Information Service, Ottawa (Ontario). Processing and Publishing Div.
A MINI-COMPUTER BASED INFORMATION SYSTEM
R. A. McIvor *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 7 p (For availability see N74-16925 08-08)

An automated information system is described based on two minicomputers, one of which is used for data input and the other for maintaining the master files and producing catalogue cards, COM cartridges, KWOC indexes, indexed document digests, and SDI notices. This production is more economical than an earlier system using a larger computer. Author

N74-16928 European Space Research Organization, Paris (France).
AEROSPACE INFORMATION SERVICES: PROGRESS WITH THE ESRO/ELDO COMPUTERIZED INFORMATION NETWORK
N. E. C. Isotta *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 15 p refs (For availability see N74-16925 08-08)

The space documentation service is a joint organization of ESRO and ELDO. Described is the present system in operation, the files available and proposed, and probable short term developments within the next year and the possible future. The present network is regarded as the forerunner of a completely distributed network with auxiliary and main nodes at strategic centers having a number of different minicomputer possibilities.
G.G.

N74-16929 Office for Scientific and Technical Information, London (England).
THE ROLE OF OSTI IN INFORMATION RESEARCH AND DEVELOPMENT
John Gray *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 3 p (For availability see N74-16925 08-08)

The contribution of OSTI to information research and development in the UK over 8 1/2 years of existence is assessed. It is divided into four main sections - mechanized information systems, information analysis centers, and general research and management research (including library automation). In each section an attempt is made to summarize the main purpose of stimulating and supporting research and the principles that guide support. A concluding section deals briefly with support of research at Aslib and with the reviews of research in selected fields that OSTI has recently launched. Author

N74-16930 Association of Special Libraries and Information Bureaux, London (England).
CURRENT ASLIB RESEARCH ON MECHANISM
B. C. Vickery *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 2 p refs (For availability see N74-16925 08-08)

An overview is given of the range of mechanization studies being carried out to explore the possibility of producing aerospace science abstracts by computer. Apart from statistical computations, computerized simulation of clerical processing in libraries is studied. The use of machine readable records to generate an index for optical searching and data processing is emphasized.
G.G.

N74-16931 Transociates Ltd., London (England).
EDUCATION AND TECHNICAL TRAINING FOR TECHNICAL INFORMATION **c34**
Felix Liebesny *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 3 p refs (For availability see N74-16925 08-08)

The educational and training facilities in the United Kingdom for scientific and technical information workers and librarians are outlined with reference to the various levels of professional attainment. The need for the training of teachers in these disciplines is stressed and some mention is made of forecast studies in supply and demand of information workers in the United Kingdom and the OECD countries. Author

N74-16932 Greater London Council (England).
MICROFILM AND REPROGRAPHIC SYSTEMS: A STATE OF THE ART REVIEW **c34**
Thomas J. Morgan *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 5 p (For availability see N74-16925 08-08)

A review of the reprographic equipment and systems is presented that covers photocomposing systems, computer output microfilming, microform retrieval and display systems, photocopiers and offset-litho duplicating. Author

N74-16933 Advisory Group for Aerospace Research and Development, Paris (France).
REMOTE TRANSMISSION AND AUTOMATED RETRIEVAL TECHNIQUES
R. Barrett (Hatfield Polytechnic, England) *In its* New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 7 p (For availability see N74-16925 08-08)

Actual developments which have taken place in the field of automatic retrieval and remote display of full text information held in microform stores and prospects for future developments are discussed. A feasibility study of remote access systems considers: (1) Information bank and storage medium, including the selector mechanism; (2) terminal equipment, including technical and user acceptability aspects; (3) transmission system; and (4) overall system economics. Although the primary interest in this study is library automation, the techniques considered are equally applicable to other automatic retrieval and remote display fields. Author

N74-16934 Naval Weapons Lab., Dahlgren, Va. Technical Information Div.
RETRIEVAL OF MICROFICHE: RANDOM ACCESS
Cathryn C. Lyon *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 7 p (For availability see N74-16925 08-08)

Three sizes of microfiche retrieval systems are discussed small, medium and large - that give random access to microfiche and film chips. There are other random systems but they are usually set up for retrieval of microfilm. This paper describes these systems and suggests indexing methods and index format for use with them. It is intended to stimulate thinking about applications that are adaptable to the readers' collections.
Author

N74-16935 Defense Documentation Center, Alexandria, Va.
A MICROFICHE SYSTEM FOR SMALL USERS

Hubert E. Sauter *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 11 p refs (For availability see N74-16925 08-08)

Microfiche are particularly well suited to the reproduction, dissemination, storage and retrieval of documents or records, particularly those of 20-98 pages. Since fiche are flat microforms they are easily retrieved and can be quickly duplicated for mailing or reference. One of the major advantages of the microfiche is a possible savings of 70 percent or more in acquisition costs when a document is available in both microfiche and paper form. Another advantage is the elimination of document storage problems, since low-cost copies of microfiche can be produced at any point on demand. In many situations, the most significant advantage is the savings in time and costs for packaging, shipping, storing, and retrieving documents. The equipment for small users for duplicating microfiche copies is quite inexpensive when compared to the cost of roll film machines. Microfiche readers and reader-printers are also considerably less expensive. The economies achieved are primarily due to simple designs, containing few moving parts or motors. Author

N74-16936 GEC-Marconi Electronics Ltd., Chelmsford (England). Research Labs.

A COMPUTER-CONTROLLABLE ULTRAFICHE TERMINAL

F. Duerden *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 7 p (For availability see N74-16925 08-08)

The Automated Microform Terminal is a hardware contribution to the problem of cost effectiveness in computer aided learning, but the resultant specification was found to meet a need in information retrieval, wherever the retrieval is from a large (say 200,000 pages upwards to many millions) or potentially large base via a computer searched index structure where a fast response is required to a specific enquiry. The terminal exploits the high storage density, handleability, and low copy cost of 149 mm x 105 mm laminated ultrafiche (X 150 magnification). It has adequate precision to select and display any one out of 6000 individually addressable A5 pages from one fiche, in .3 to 1.7 seconds, under digital control either from computer or keyboard. The addition of a small magazine or cassette under development, with automatic fiche selection and capacity for 1/4 million pages, makes the system capacity virtually open ended. Author

N74-16937 European Atomic Energy Community, Luxembourg.

ABSTRACTS ON MICROFICHE FOR ON-LINE RETRIEVAL

Carl O. Vernimb *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 13 p (For availability see N74-16925 08-08)

A short description of the characteristics of the European nuclear documentation service is given: sources of information, structure of the thesaurus, file organization, retrieval strategy, system performance, and user behavior. Three recent developments are described: (1) Installation of a terminal for system/user dialog; direct access to part of the data base (200,000 documents) allows for query adjustment by evaluating the relevance of titles presented on the screen; the adjusted query formulation is applied to the total data base of 1.3 million documents; (2) installation of a microfiche reader-printer with a capacity of close to 300,000 abstracts; the abstracts are presented on a ground-glass screen within 4 seconds after keying in the corresponding reference numbers; and (3) introduction of a relevance feedback routine; relevance decisions gathered when adjusting the query formulation are fed back into the computer together with the adjusted query; the descriptors are weighted according to their occurrence in relevant and irrelevant documents; the documents are ranked according to the sum of weights of their descriptors, and printed out in order of decreasing probability. Author

N74-16938 Mullard Research Labs., Salfords (England).

A RESEARCH WORKER'S VIEW ON THE FUTURE OF AUTOMATIC READING MACHINES

J. A. Weaver *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 8 p refs (For availability see N74-16925 08-08)

A general account of the justification for the use of automatic reading machines in a commercial data processing environment is presented. A broad outline of the tasks of the component parts of a reading system is given, together with an indication of how modern reading machines are being made more cost effective than their predecessors. A section is included on the recognition of handprinted material. Future techniques which may increase the capability of reading machines whilst maintaining the current trend towards reducing size and cost are considered. Optical character recognition has been in existence for several years - at a price. It will become very widely used over the next few years as prices fall and data processing managers realize how to use the technique effectively. Author

N74-16939 Hawker Siddeley Aviation, Ltd., Kingston upon Thames (England).

ALL CHANGE FOR AERONAUTICS

John E. Allen *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 5 p (For availability see N74-16925 08-08)

The continuing patterns of changes in design, methods, subjects, fashion and major frameworks of reference have not only increased the volume of aerospace information but its complexity. The information world has responded to this by evolving more and more sophisticated indexing languages, thesaurus classification and automated retrieval. However, there is no consensus of opinion of a best way to proceed and as time goes on and first and second generation automatic systems come into use it will be increasingly difficult to introduce later methods because of the large capital replacement cost involved in such major changes. Costs of complex information systems may become an unacceptable proportion of organisational activity. Moreover such complexity and the existence of automatic systems may make too large demands on staff time, leaving less for consideration of the library/user interface. Often, in aircraft design there are similar tendencies - advanced technology may give a somewhat better aircraft but often only at the expense of more cost, complexity, unreliability etc. Good aeroplanes result from good design which is a strict discipline in avoiding unnecessary elaboration, complexity or cost. In this sense a streamlining and avoidance of duplication, unnecessarily elaborate gadgets etc., may be advantageous. Author

N74-16940*# Analysis and Computer Systems, Inc., Burlington, Mass.

DATA PROCESSING SYSTEM FOR THE INTENSITY MONITORING SPECTROMETER FLOWN ON THE ORBITING GEOPHYSICAL OBSERVATORY-F (OGO-F) SATELLITE Final Report, 1 Jul. 1970 - 30 Jun. 1973

Allan G. Cronin and James R. Delaney Jul. 1973 87 p refs (NASA Order S-99821; Contract F19628-70-C-0298; AF Proj. 6688)
(NASA-CR-136827; AFCRL-TR-73-0655) Avail: NTIS HC $7.50 CSCL 09B

The system is discussed which was developed to process digitized telemetry data from the intensity monitoring spectrometer flown on the Orbiting Geophysical Observatory (OGO-F) Satellite. Functional descriptions and operating instructions are included for each program in the system. Author

N74-16941# Royal Aircraft Establishment, Farnborough (England).

THE LOOK-ANGLE PREDICTION PROGRAMS PLAP ESPLAP AND 6130PLAP

R. H. Gooding and A. W. Odell Aug. 1973 70 p refs (RAE-TR-73088; BR36548) Avail: NTIS HC $6.50

Descriptions are given of three FORTRAN programs for the prediction of satellite look angles: PLAP, a member of the PROP family of programs, is limited to prediction for a single station; ESPLAP, based on the ESRO programs, will provide a world map of predictions for up to 16 stations; 6130PLAP, a new program capable of predictions for up to seven stations, was rewritten for efficient operational use on the EMR 6130 computer. The orbital elements used by the three programs are compared, and details of an improvement to the PROP orbital model (orbit generator) are given. ESRO

N74-16942# Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.

INFORMATION PROCESSING/DATA AUTOMATION

IMPLICATIONS OF AIR FORCE COMMAND AND CONTROL REQUIREMENTS IN THE 1980S (CCIP-85). VOLUME 10: CURRENT R AND D (REVISED)
Oct. 1973 75 p refs Revised
(AD-768979; SAMSO/XRS-71-1R-Vol-10) Avail: NTIS CSCL 09/2

The volume of the CCIP-85 study surveys current and projected technology programs in information processing, both hardware and software, to establish a base line concerning a deficiency analysis of the current programs to meet the CCIP-85 technology requirements. Author (GRA)

N74-16943# Ohio State Univ., Columbus. Electroscience Lab.
A STUDY OF THE FOURIER TRANSFORM METHOD OF IMAGE RESTORATION Quarterly Report, 1 Jan. - 31 Mar. 1973
R. S. Davidson, II Sep. 1973 93 p refs
(Contract F30602-72-C-0305; ARPA Order 1279; AF Proj. 1279)
(AD-770321; ESL-3432-3) Avail: NTIS CSCL 09/2

The report examines the Fourier transform method of restoring degraded images of point objects. The principal conclusion supported by the study is that the major problem in restoring these images is the presence of poles in the restored image spectrum. A series of figures showing three restored image quality criteria graphed as functions of image degradation, for a computer modeled degraded imaging system, are presented to support this conclusion. Also included is a thorough mathematical analysis of the restored image spectrum. GRA

N74-16944# Oregon State Univ., Corvallis. School of Oceanography.
USE OF ON-LINE COMPUTERS IN ENVIRONMENTAL RESEARCH Final Report
Wayne V. Burt Oct. 1973 11 p refs
(Contract N00014-68-FA-0148; NR Proj. 083-230)
(AD-770614; Ref-73-18) Avail: NTIS CSCL 09/2

A real time data acquisition/central system has been developed for environmental monitoring and research. The basic elements of the system are a large instrumented spar buoy, a computer which controls data acquisition through a telemetry link and simultaneously files and analyzes the data, and the investigator who prescribes appropriate sets of computer operations. The system has particular advantages for real time operational decision making and for nonstandard environmental investigations. Author (GRA)

N74-16945# Transportation Systems Center, Cambridge, Mass.
AIRPORT INFORMATION RETRIEVAL SYSTEM (AIRS) Final Report
Manuel F. Medeiros and Julie Sussman Oct. 1973 87 p refs
(AD-770071; TSC-FAA-73-25; FAA-RD-73-122) Avail: NTIS CSCL 17/7

The handbook is a support manual for a prototype air traffic flow control automation system developed for the FAA's Systems Command Center. The system is implemented on a time-sharing computer and is designed to provide airport traffic load predictions and flow control support. The manual is designed for use by an experienced computer programmer. It contains instructions on performing the monthly AIRS data base updating including the Official Airline Guide data tape processing, the merging with the existing data base and the maintenance of the associated supporting data files. The manual describes the duties associated with monitoring nightly file checking and failsafe programs to assure data base integrity. The daily processing and troubleshooting of the system's usage records are also described. (Modified author abstract) GRA

N74-16946# Stanford Univ., Calif. Electronics Labs.
REDUNDANCY TESTING IN COMBINATIONAL NETWORKS
Hsiao-Peng Sherman Lee and Edward S. Davidson May 1973 76 p refs
(Contract N00014-67-A-0112-0044; Grant NSF GJ-35584)
(AD-770541; SU-SEL-73-035) Avail: NTIS CSCL 09/2

A simple, necessary and sufficient test is developed for testing whether a single connection in a tree-type NAND network is redundant. A procedure is presented for testing every connection in the network. The computational complexity of the procedure is m(i squared) where m = the number of gates and i = the average numbers of inputs per gate in the network. The redundancy test is generalized for multi-output tree-type NAND networks and such networks realizing partially specified functions. A dual test is developed for tree-type NOR networks, but NOR networks for partially specified functions are treated by a simpler test than the dual test. The test may be applied to AND-OR networks as well by converting them, at least conceptually, to an equivalent NAND form while preserving redundancy. (Modified author abstract) GRA

N74-16947# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
SOME PROPERTIES OF STRING TRANSDUCERS
Russell J. Abbott Sep. 1973 84 p refs
(Contract N00014-67-A-0269-0020)
(AD-770836; TR-2) Avail: NTIS CSCL 09/2

The paper compares the computational power of various classes of transducers. A transducer is an automaton which transforms an input string into an output string, where both the input and output strings consist of symbols from some finite alphabet of symbols. A transducer performs its computations on a working tape of discrete squares. Each square may contain one symbol from a finite working alphabet. A transducer M is said to be a member of the class m(L(n)) of L(n) space bounded transducers if, whenever M completes a computation on an input of length n, then M makes use of no more than L(n) squares of working tape. It is shown that the class m(log(n)) is closed under finite composition. (Modified author abstract) GRA

N74-16948# Stanford Univ., Calif. Electronics Labs.
INTERCONNECTIONS FOR PARALLEL MEMORIES TO UNSCRAMBLE P-ORDERED VECTORS
Roger C. Swanson May 1973 55 p refs
(Contract N00014-67-A-0112-0044; Grant NSF GJ-1180; AF Proj. 6970)
(AD-770552; SU-SEL-73-032; SU-STAN-CS-73-388; TR-74) Avail: NTIS CSCL 09/2

Several methods are being considered for storing arrays in a parallel memory system so that various useful partitions of an array can be fetched from the memory with a single access. Some of these methods fetch vectors in an order scrambled from that required for a computation. The paper considers the problem of unscrambling such vectors when the vectors belong to a class called p-ordered vectors and the memory system consists of a prime number of modules. Pairs of interconnections are described that can unscramble p-ordered vectors in a number of steps that grow as the square root of the number of memories. Lower and upper bounds are given for the number of steps to unscramble the worst case vector. The upper bound calculation that is derived also provides an upper bound on the minimum diameter of a star polygon with a fixed number of nodes and two interconnections. An algorithm is given that has produced optimal pairs of interconnections for all sizes of memory that have been tried. The algorithm appears to find optimal pairs for all memory sizes, but no proof has yet been found.
Author (GRA)

N74-16949# Stanford Univ., Calif. Electronics Labs.
AN ALGORITHM FOR MINIMAL TANT NETWORK GENERATION
Hsiao-Peng Sherman Lee Aug. 1973 86 p refs
(Contract N00014-67-A-0112-0044; Grant NSF GJ-35584)
(AD-770555; SU-SEL-73-036; TR-68) Avail: NTIS CSCL 09/2

An algorithm for constructing minimal TANT network (minimum gate three level and-not gate network with true inputs) is presented. The upper prime permissible implicants of a function are first generated from the H-maximum compatibility classes of the prime implicants. Using the upper prime permissible implicants as candidates, two particular networks, A and B, are then constructed. Network A has the minimum number of third level gates among all networks that have the minimum number of second level gates. Network B has the minimum number of second level gates among all networks that have the minimum number of third level gates. For most functions with few variables,

it can be shown that one or both of these two networks is a minimal TANT network. (No function with less than nine variables has been found which violates the above statement.) For other functions, upper and lower bounds for both the second level and third level gates are derived. (Modified author abstract)
GRA

N74-16950# Office of Naval Research, London (England).
CONFERENCE ON COMPUTER AIDED CONTROL SYSTEM DESIGN
A. H. Waynick 10 Sep. 1973 14 p refs Conf. held at ONRL, Cambridge, Eng., 2-4 Apr. 1973
(AD-770123; ONRL-C-20-73) Avail: NTIS CSCL 09/2

Subjects pertaining to utilizing computers in the design of control systems are considered. These include: optimal control, system optimization, modern frequency domain techniques, man-machine interactions, interactive graphics and computer aided control system design programs. Extended discussions on the last two topics are reported upon. Author (GRA)

N74-17662 Joint Publications Research Service, Arlington, Va.
ACADEMY SESSION ON DIGITAL PROCESSING AND TRANSMISSION OF INFORMATION
In its Transl. on Eastern Europe Sci. Affairs, No. 383 (JPRS-61101) 30 Jan. 1974 p 13-18 Transl. into ENGLISH from Posta si Telecomunicatii (Bucharest), no. 10, Oct. 1973 p 472-573 Conf. held at Bucharest, 4-6 Oct. 1973 (For availability see N74-17661 08-34)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-16951 Colorado State Univ., Fort Collins.
LOADED ANTENNAS FOR SHORT PULSE APPLICATIONS Ph.D. Thesis
Gerald C. Rose 1973 194 p
Avail: Univ. Microfilms Order No. 73-29059

The radiation of transient signals is studied to determine what conditions antennas must satisfy to minimize the distortion contributed by the antenna. The conditions suggest the use of V configured traveling wave antennas, which appear to satisfy to a large degree the conditions necessary for good transient performance. Studied in particular are a cylindrical antenna with tapered resistive loading to achieve an outward traveling wave current distribution, and a new antenna consisting of a high conductivity cylinder terminated by a resistively loaded end section. The current distribution, input admittance, and the terminal voltage for an impulsive incident field are calculated numerically for these antennas and the numerical results are verified experimentally. Dissert. Abstr.

N74-16952 Northwestern Univ., Evanston, Ill.
STUDY OF InSb THIN-FILM TRANSISTOR Ph.D. Thesis
Fang-Chen Luo 1973 97 p
Avail: Univ. Microfilms Order No. 73-30654

A thin film transistor, using very thin flash evaporated and annealed InSb film as semiconductor in a coplanar electrode structure, is characterized by a relatively large transconductance and a well defined saturation region at room temperature. Units which have dimensions of 1 mil x 18 inch have transconductances of up to 6000 micron mhos. Strong strain sensitivity was demonstrated by InSb TFT. With a load resistance of 100,000 ohms, strain sensitivities of up to 8,000 volts per unit strain were achieved. Vacuum deposited CaF2 and SiO layers were demonstrated to cause depletion layers on the surface of InSb films. Dissert. Abstr.

N74-16953*# Advisory Group for Aerospace Research and Development, Paris (France).
ROLL PLANE ANALYSIS OF ON-AIRCRAFT ANTENNAS
W. D. Burnside (Ohio State Univ.), R. J. Marhefka (Ohio State Univ.), and C. L. Byu (Ohio State Univ.) 30 Jan. 1974 22 p refs Presented at 26th Tech. Meeting of the Avionics Panel of AGARD, Munich, Nov. 1973 Prepared by Ohio State Univ.
(Grant NGR-36-008-144)
(NASA-CR-136815) Avail: NTIS HC $3.25 CSCL 09E

Roll plane radiation patterns of on-aircraft antennas are analyzed using high frequency solutions. Aircraft-antenna pattern performance in which the aircraft is modelled in its most basic form is presented. The fuselage is assumed to be a perfectly conducting elliptic cylinder with the antennas mounted near the top or bottom. The wings are simulated by arbitrarily many sided flat plates and the engines by circular cylinders. The patterns in each case are verified by measured results taken on simple models as well as scale models of actual aircraft. Author

N74-16954*# Singer Co., Little Falls, N.J. Kearfott Div.
SOLID STATE SWITCH PANEL Final Report
E. Beenfeldt 26 Nov. 1973 115 p
(Contract NAS9-13144)
(NASA-CR-134188; Y256A226) Avail: NTIS HC $8.75 CSCL 09E

An intensive study of various forms of transducers was conducted with application towards hermetically sealing the transducer and all electronics. The results of the study indicated that the Hall effect devices and a LED/phototransistor combination were the most practical for this type of application. Therefore, hardware was developed utilizing a magnet/Hall effect transducer for single action switches and LED/phototransistor transducers for rotary multiposition or potentiometer applications. All electronics could be housed in a hermetically sealed compartment. A number of switches were built and models were hermetically sealed to prove the feasibility of this type of fabrication. One of each type of switch was subjected to temperature cycling, vibration, and EMI tests. The results of these tests are presented. Author

N74-16955# Danish Research Center for Applied Electronics, Hoersholm.
SMALL SIGNAL TRANSISTORS: A STUDY OF PLASTIC- OR METAL-ENCAPSULATED TRANSISTORS. HIGH PRESSURE OF PARAMETRIC STABILITY IN TO-92 PLASTIC ENCAPSULATION [SMASIGNAL TRANSISTORER: EN UNDERSOEGELSE AFPLAST- OG METALINDKAPSLEDE TRANSISTORERS PARAMETERSTABILITET MED HOVED-VAEGT PA TO-92 PLASTINDKAPSLING]
H. J. Nordby Nov. 1973 49 p refs In DANISH; ENGLISH summary
(ECR-37) Avail: NTIS HC $5.50

Twelve types of small signal transistors were tested. Totally 1380 transistors were tested distributed on seventeen variants. Out of these, however, two were enclosed in metal encapsulation TO-18 in order that a comparison could be made between plastic and metal encapsulations. The measurement of the dc parameters of the transistors was supplemented by a noise measurement to examine whether it is possible to obtain a connection between noise and reduced lifetime, if any. The test result was the instability of dc current gain. Especially in case of low current, the current gain is flowing and with a tendency to wide dissipation. Author

N74-16956# Danish Research Center for Applied Electronics, Hoersholm.
INTEGRATED VOLTAGE REGULATORS: A STUDY OF REGULATION CAPACITIES AND STABILITIES ON 8 TYPES EXPOSED TO VARIOUS ENVIRONMENTS [INTEGREREDE SPAENDINGSREGULATORER: EN UNDERSOGELSE AF 8 TYPERS REGULE-RINGSNOJAGTIGHED OG STABILITET UNDER FORSKELLIGE MILJOPAVIRKNINGER]
U. Fabricius Oct. 1973 66 p In DANISH; ENGLISH summary
(ECR-35) Avail: NTIS HC $6.50

An investigation is presented of the stability qualities of series and shunt regulators when exposed to various environments. The investigation of electrical factors was emphasized, i.e. ripple rejection, pulse rejection, and change due to self-heating. The results obtained are graphically represented, and a comparison between the various types and manufactures is presented.
Author

N74-16957# Commissariat a l'Energie Atomique, Villeneuve-Saint-Georges (France). Centre d'Etudes de Limeil.
CONTRIBUTION TO THE STUDY OF NONCYLINDRICAL FOCUSED ELECTRICAL DISCHARGE Ph.D. Thesis - Paris Univ.
C. Patou Sep. 1973 124 p refs In FRENCH
(CEA-R-4452) Avail: AEC Depository Libraries HC $8.25

The dynamics of a 15-kJ capacitor bank powered discharge and the characteristics of the X-rays and neutrons emitted are described. The dynamics of the discharge is compared to the results of two different two dimensional numerical codes: snowplow and magnetohydrodynamic. When the neutron emission is nearly isotropic, the electron temperature is measured from the X-rays radiated by the plasma. For these dischargers, X-ray and neutrons are coming from the same regions of the plasma, and a thermonuclear origin of the neutrons cannot be avoided. When the initial gas pressure is lowered, the neutron emission becomes strongly anisotropic and difficult to study.
Author (NSA)

N74-16958# AEG-Telefunken, Ulm (West Germany).
INVESTIGATIONS ON THE DEVELOPMENT OF A NONRECIPROCAL GaAs TRAVELING WAVE AMPLIFIER FOR CONTINUOUS WAVE OPERATION [UNTERSUCHUNGEN ZUR REALISIERUNG EINES NICHT-REZIPROKEN GaAs-WANDERFELD-VERSTAERKERS FUER DAUERSTRICHBETRIEB]
R. Becker, R. Engelmann, W. Frey, W. Heinle, and K. Keller Bonn Bundeswehramt 1973 88 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-25) Avail: NTIS HC $7.50 Bundeswehramt 30 DM

A GaAs traveling wave amplifier was developed for continuous wave operation and for X-band frequencies. The measured properties are given. Investigations of the potential distribution across stable devices revealed a strong influence of the nature of the anode on the potential profile. Particular difficulties arose because of leakage currents across the semi-insulating substrates at relatively low voltages. Therefore, it was necessary to attach the devices to the electrically conducting heat sink with electrically insulating epoxy. Theoretical estimates of the internal power per width in an epitaxial layer are given. The properties of the space charge waves are discussed theoretically in detail.
Author (ESRO)

N74-16959# Hawker Siddeley Dynamics, Ltd., Stevenage (England).
CIRCUIT DESIGN REPORT FOR A MOMENTUM WHEEL MOTOR CURRENT CONTROL UNIT
J. E. Haines [1973] 55 p
(Contract ESTEC-1522/71)
(HSD-TN-3868; ESRO-CR(P)-340) Avail: NTIS HC $5.75

Design, theoretical performance, test results, and reliability of a momentum wheel motor current control unit, to be employed at the European Space Technology Centre, are discussed. Design considerations of the closed loop current regulator include configuration, input stage, comparator stage, power switching stage, and output filter. Theoretical performance parameters such as gain accuracy, output offset current, gain stability, offset stability, frequency response, efficiency, and deadband region are discussed. Also the dc transfer, temperature, frequency response, and control unit efficiency were tested. The reliability of the current control unit is described in detail. ESRO

N74-16960# Information Systems, Menlo Park, Calif.
ANTENNA MODELING OF THE KC-135 Final Technical Report
G. J. Burke, E. S. Selden, and K. Hazard Jul. 1973 183 p
(Contract F30602-72-C-0135)
(AD-769913; IS-R-73/02; RADC-TR-73-195) Avail: NTIS CSCL 09/5

Geometry generators compatible with the RADC Antenna Modeling Program (AMP) and augmented for the KC-135 aircraft electronic test bed configuration for the HF band. Author (GRA)

N74-16961# Stanford Univ., Calif. Microwave Lab.
MICROWAVE ACOUSTIC AND BULK DEVICE TECHNIQUE STUDIES Interim Technical Report, 1 Nov. 1972 - 30 Apr. 1973
Marvin Chodorow and H. J. Shaw Aug. 1973 59 p refs
(Contract F30602-71-C-0125; AF Proj. 5573)
(AD-769866; ML-2181; RADC-TR-73-269; ITR-6) Avail: NTIS CSCL 09/1

Major improvements are reported on a bulk wave device for parametric convolution/correlation, time reversal and real-time Fourier transformations of arbitrary signals. A wideband waveguide output circuit has permitted an increase by a factor of 5 in the bandwidth for convolution, resulting in demonstration of pulse compression with a time-bandwidth product of 875 and an output pulse of 4 nanosecond width. Work is described on new approaches to parametric convolution/correlation and matched filtering, using various acoustic wave types in piezoelectric semiconductors, which have prospects for incorporation into integrated circuits. New procedures and diagnostic techniques have been applied to the deposition of piezoelectric films for excitation of surface acoustic waves on nonpiezoelectric substrates, with potential for improved delay line properties and incorporation into integrated circuits. (Modified author abstract) GRA

N74-16962# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTING S-BAND Final Report, 1 Mar. - 14 Jun. 1973
Lester A. Roberts Nov. 1973 36 p refs
(Contract DAAB07-72-C-0220)
(AD-769904; ECOM-0220-3-72) Avail: NTIS CSCL 09/5

The construction and testing of the life test tubes which was begun in the last reporting period was continued. Five tubes were processed with a total of ten diodes. Sheet beam dispenser cathodes were designed and ordered. A new diode failure mechanism appeared in the presence of the electron beam which does not seem to be related to previously solved problems. None of these devices were able to be plated on extended life test. Design procedures became available from other programs during the period for tuned resonant circuit amplifiers which relate physical design parameters to bandwidth and power output. Accurate S-band designs were then calculated which indicate achievable performance. Cold testing took place of a radial transmission line resonator suitable for use in a tuned amplifier at 3.2 GHz. (Modified author abstract) GRA

N74-16963# General Electric Co., Schenectady, N.Y. Research and Development Center.
MONOLITHIC LIGHT EMITTING DIODE DISPLAY Final Technical Report, 1 Mar. 1972 - 28 Feb. 1973
Lawrence C. Kravitz Aug. 1973 35 p
(Contract DAAB07-72-C-0125; DA Proj. 1S6-62705-A-055)
(AD-769903; SRD-73-131; ECOM-0125-F-72) Avail: NTIS CSCL 09/5

The objective of the contract was the development of technologies required for an LED (Light Emitting Diode) display system based on monolithic LED arrays and large scale flip-chip bonding. The report describes the general system design and progress achieved during the contract period. The technical aspects include epitaxial growth, alloy metalizations, pyrolytic glass deposition, multilevel ceramic substrates, and electronic system design. (Modified author abstract) GRA

N74-16964# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A SINGLE-FEED, HIGH-GAIN, CIRCULARLY POLARIZED S-BAND ANTENNA AND ITS TEST COUPLER
Kuo-Chun Lang 5 Jul. 1973 31 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-769907; TN-1973-31; ESD-TR-73-181) Avail: NTIS CSCL 09/5

The development of a single-feed, high-gain, circularly polarized cup-dipole antenna, operated over the frequency band of 2.24-2.25 GHz, and its test coupler is described. The antenna consists of a turnstile feed of crossed dipoles of unequal lengths, backed by a cup cavity. With a cup size of 1.33 wavelength in diameter, it produces a gain of 12.7 db when matched to a VSWR of 1.1. This corresponds to an effective receiving area 6% larger than the physical area. An even higher gain of 13.4 db, or an aperture efficiency of 122.5%, is observed when the antenna is flush-mounted on a large plate. The radiation pattern shows that the antenna has a half-power beamwidth of

approximately 40 degrees and an axial ratio of < or = 0.5 db over the angular region of plus or minus 10 degrees off boresight. (Modified author abstract) GRA

N74-16965# Stanford Research Inst., Menlo Park, Calif.
EFFECTS OF PLASMA ON POLYROD ANTENNA Interim Technical Report No. 1
W. C. Taylor Mar. 1973 39 p refs Prepared for Lincoln Lab., MIT, Lexington
(Contract F19628-70-C-0230; AF Proj. 627A; SRI Proj. 1974)
(AD-769957; SRI-1974-1; ESD-TR-73-82; ITR-1) Avail: NTIS CSCL 09/5

The report describes predictions for reentry attenuation of a polyrod antenna covered by a conical nose cone. It also details the steps leading to these predictions, which are: (1) Determination of reentry-plasma properties from previous calculations and flight-test measurements. (2) Measurements of attenuation and pattern changes as the reentry plasma was simulated over the nose cone. The plasma at low altitudes was simulated by using a high-loss dielectric called space cloth. For high-altitude simulation, high-power X-band pulses fed through the same polyrod antenna were used to ionize a thin layer of helium around the cone. Predictions are given for various nose radii and for either teflon or carbon cone material. Author (GRA)

N74-16966# Electrospace Systems, Inc., Richardson, Tex.
THE 30 MHz TO 80 MHz VHF BROADBAND DIRECTIONAL LOG PERIODIC ANTENNA STUDY Final Report, 1 Mar. 1972 - Aug. 1973
William A. Kennedy, Antonino G. Medina, Donald L. Holzschuh, and Larry M. Cobb Aug. 1973 87 p refs
(Contract DAAB07-72-C-0137; DA Proj. 1H6-63707-C-246)
(AD-769902; ECOM-0137-F-72) Avail: NTIS CSCL 09/5

The antenna was designed to increase the range of Army ground radio units such as the VRC-12 in fixed station application. Propagation analysis indicates a range improvement of double that normally available from existing field antenna systems. GRA

N74-16967# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
COPLANAR WAVEGUIDE FABRICATION AND CHARACTERISTICS Final Report, 15 Jun. 1972 - 15 May 1973
Mark E. Davis Sep. 1973 98 p refs
(AF Proj. 6098)
(AD-770024; AFAL-TR-73-189) Avail: NTIS CSCL 09/1

The effort considers the analysis and design of coplanar waveguide transmission lines for microwave applications to circuits. The major significance to the Air Force was the development of a transmission line that was low cost, easily fabricated and which lent itself to integration of microwave devices and circuit elements. It has been found that the coplanar waveguide meets to a great extent all the above criteria; however, because of the field orientation in the guide a large amount of energy is contained below the substrate as well. The coplanar waveguide then will have limited use in high density circuitry because of its tendency to propagate higher order modes and therefore interfere with adjacent circuitry. The major effort in the analysis was the determination of waveguide impedance for finite substrate thickness and various line geometries. (Modified author abstract) GRA

N74-16968# Hughes Aircraft Co., Fullerton, Calif. Microwave Techniques Dept.
ULTRA-WIDEBAND PHASED ARRAYS Final Report, 15 Mar. 1972 - 15 Jun. 1973
Chao Chun Chen, N. S. Wong, and R. Tang Jul. 1973 72 p refs
(Contract F19628-72-C-0224; AF Proj. 4600)
(AD-769965; FR-73-14-922; AFCRL-TR-73-0569) Avail: NTIS CSCL 09/5

The report describes the activities and accomplishments associated with the two major technical tasks on this project. The first task is the development of a linearly polarized two-dimensional phased array which is well matched simultaneously over a large scan angle range and over an octave bandwidth. The second task is to extend the impedance matching of the linearly polarized element to an arbitrarily polarized element for wide-angle scanning and wide tunable bandwidth. GRA

N74-16969# Valpey-Fisher Corp., Hopkinton, Mass.
SHOCK RESISTANT QUARTZ CRYSTAL UNITS Final Report, 1 Jun. 1971 - 1 Jun. 1972
William T. Liggett Mar. 1973 113 p
(Contract DAAB07-71-C-0245)
(AD-769901; ECOM-0245-F-71) Avail: NTIS CSCL 09/1

The report covers testing of crystal units. The crystal units were manufactured to specifications for Type CR-64/U at 2.90000, 4.60000, 7.40000, 12.0000 and 20.0000 MHz. A complete data analysis indicated that the mounting of the crystal is the critical point in the fabrication of the units. Appropriate additions to the spring-blank bonding process is described. Furthermore, it was found that pre-aging the crystals was necessary to achieve the required stability. (Modified author abstract) GRA

N74-16970# RAND Corp., Santa Monica, Calif.
SOVIET DEVELOPMENT OF NEEDLE-TIP FIELD-EMISSION CATHODES FOR HIGH-CURRENT ELECTRON BEAMS
Simon Kassel and Charles D. Hendricks Aug. 1973 24 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-770608; R-1311-ARPA) Avail: NTIS CSCL 20/7

The paper summarizes recent Soviet theoretical and experimental work on cathodes for very high-current charged particle beams. Field emission from needle-tip cathodes is based on explosive emission from the tips, accompanied by explosion-derived plasma setting up intense local electric fields. A cathode fabrication method is described that gives stable operation through 10,000 to 100,000 pulses of about 3 nanoseconds each, for currents of 500 to 1000 A. A liquid cathode produces stable current pulses within 6 percent of 2000 A. In a large needle array, 80 percent to 100 percent of the tips maintained current value dispersion within 20 percent. Operational cathodes of the controllable tip-and-dielectric type have been developed for 500 keV and 50 kA, and of the multiple-tip types for 1 MeV and 50 kA. GRA

N74-16971# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THE TRANSITION FIELD ON THE SURFACE OF SLOT EXCITED CONICAL ANTENNA Report for Jan. - Mar. 1973
David C. Pridmore-Brown 31 Oct. 1973 14 p refs
(Contract F04701-73-C-0074)
(AD-769842; TR-0074(9260-09)-3; SAMSO-TR-73-312) Avail: NTIS CSCL 09/5

A previous derivation of the transition field on the surface of a slot-excited conical antenna is corrected, and the new result as well as the tip diffraction coefficient are checked by a calculation involving only the exact normal mode series. Author (GRA)

N74-16972# Aerospace Corp., El Segundo, Calif. Lab Operations.
THE SUPER-SCHOTTKY BARRIER DIODE DETECTOR Report for Feb. 1972 - Jan. 1973
Malcolm McColl, Michael F. Millea, and Arnold H. Silver 15 Sep. 1973 15 p refs
(Contract F04701-73-C-0074)
(AD-769846; TR-0074(4230-50)-1; SAMSO-TR-73-322) Avail: NTIS CSCL 09/1

The superconductor-semiconductor contact diode, or super-Schottky barrier diode, has been examined theoretically and experimentally as a detector of high frequency radiation. Theoretical analysis based on its volt-ampere characteristic indicates the proposed diode is superior to the ordinary cooled Schottky barrier diode as a direct detector by two orders of magnitude in sensitivity. Moreover, the reliability established for the ordinary Schottky barrier diode is in evidence for the proposed diode. The doping of the semi-conductor is chosen large enough so that electron tunneling dominates the volt-ampere behavior of the diode. As such, for the T-(TsubC) and V- delta, the diode exhibits a high degree of nonlinearity in its volt-ampere

characteristic. It is this nonlinearity that the super-Schottky diode exploits. (Modified author abstract) GRA

N74-16973# Naval Underwater Systems Center, New London, Conn. New London Lab.
A GENERAL METHOD AND FORTRAN PROGRAM FOR THE DESIGN OF RECURSIVE DIGITAL FILTERS
Joseph J. Wolcin 25 Sep. 1973 48 p
(AD-769211; NUSC-TR-4629) Avail: NTIS CSCL 09/5

A general method for the design of digital filters is presented, and a FORTRAN program that follows the steps of the method is described. The computer program can design any low-pass, high-pass, bandpass, or band-reject digital filter by using either Butterworth, Chebyshev, or elliptic approximations to the ideal rectangular type frequency response. The user need only provide the program with a set of structured specifications, and as output the user obtains the transfer function of the minimum order filter that meets his requirements. For convenience, the transfer function is expressed in a form that allows immediate implementation in a cascade type realization. Author (GRA)

N74-16974# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FREQUENCY CONVERSION EFFICIENCY FOR HIGHLY DAMPED CURRENT CONTROLLED JOSEPHSON JUNCTIONS Technical Report, Jul. - Dec. 1972
Helmut Kantor 5 Nov. 1973 36 p refs
(Contract F04701-73-C-0074)
(AD-769845; SAMSO-TR-73-323; TR-0074(9230-02)-2) Avail: NTIS CSCL 09/5

The efficiency of down conversion from a high frequency to an intermediate frequency is calculated for a current driven superconducting weak link in parallel with a resistor. Cases in which the internal, bias-controlled oscillation functions as the local oscillator and in which an external local oscillator is used are considered. The description of the former mode of operation is based on a previously published perturbation treatment of the model in the small signal limit. Accordingly the junction as free running oscillator interacts parametrically with the applied signal. The resulting gain at the signal frequency is negated by the loss in the parametric conversion process to the intermediate frequency. The junction output is thus independent of the intermediate frequency. (Modified author abstract) GRA

N74-16975# Microwave Associates, Inc., Burlington, Mass.
RELIABILITY OF HIGH FIELD SEMICONDUCTOR DEVICES Semiannual Report, 1 Apr. 1972 - 1 Apr. 1973
T. B. Ramachandran and J. L. Heaton Nov. 1973 97 p refs
(Contract DAAB07-72-C-0101)
(AD-770528; ECOM-0101-72-2; SAR-2) Avail: NTIS CSCL 09/1

The interim report describes the results of a continuing program of investigation concerning the reliability and failure modes of gallium arsenide Gunn and IMPATT diodes, and silicon IMPATT diodes. Data is presented concerning the burn-out distribuiton in time of Gunn diodes. Also, the changes in dc and RF parameters of 700 Gunn and 100 gallium arsenide IMPATT diodes resulting from 24 to 168 hours of dc high temperature burn-in are present. (Modified author abstract) GRA

N74-16976# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.
DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Report, 15 Mar. - 15 Jun. 1973
Walter F. Goede Oct. 1973 27 p
(Contract DAAB07-72-C-0076; DA Proj. 1S6-62705-A-055)
(AD-769899; NORT-72-280-5; ECOM-0076-5-72; QR-5) Avail: NTIS CSCL 09/5

The report describes the progress which occurred during the fifth quarter of a Research and Development contract to develop a 512 x 512 resolution-element display with a resolution of 55 holes-per-inch. This digitally addressed thin display tube is being developed to evaluate and demonstrate the feasibility of using this display concept to meet Army requirements for a computer-output display. (Modified author abstract) GRA

N74-17408* Stanford Univ., Calif.
PHOTOCATHODES FOR USE IN THE LARGE SPACE TELESCOPE PROGRAM
W. E. Spicer *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 21-34 ref (For availability see N74-17406 08-23)
CSCL 09A

N74-17411* CBS Labs., Stamford, Conn.
THE ELECTROSTATIC STORAGE TUBE
R. E. Rutherford, Jr. *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 69-80 (For availability see N74-17406 08-23)
CSCL 09A

N74-17413* California Inst. of Tech., Pasadena.
APPLICATION OF SILICON IMAGE TUBES (SIVIT AND SIT) TO GROUND-BASED ASTRONOMY
J. A. Westphal *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 93-106 (For availability see N74-17406 08-23)
CSCL 09A

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-16977*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
SYNTHESIS OF OSCILLATING ADAPTIVE FEEDBACK SYSTEMS
John W. Smay 1 Jun. 1973 239 p refs
(Grant NGR-06-003-083; NSF GK-33485)
(NASA-CR-136940) Avail: NTIS HC $15.00 CSCL 09C

A synthesis theory is developed which allows system design to proceed from practical specifications on system command and/or disturbance response to a design which is very nearly optimal in terms of feedback sensor noise effects. The approach taken is to replace the nonlinear element by a mean square error minimizing approximation (dual-input describing function), and then use linear frequency domain synthesis techniques subject to additional constraints imposed by the limit cycle and the approximator. Synthesis techniques are also developed for a similar system using an externally excited oscillating signal with the above approach. The results remove the design of the systems considered from the realm of simulation and experimentation, permitting true synthesis and the optimization that accompanies it. Author

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-16978*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIRST HEATED JETTISON TEST ON THE CENTAUR STANDARD SHROUD
Jan. 1974 122 p ref
(NASA-TM-X-71501; E-7868) Avail: NTIS HC $8.25 CSCL 14B

The first in a planned series of heated jettison tests on the Centaur Standard Shround was conducted at NASA Plum Brook Station's Space Power Facility on November 19, 1973. The first 250-second portion of the test sequence involved heating the shroud with a specially-built fixture designed to provide a simulation of the heating environment encountered by the shroud

during its ascent through the earth's atmosphere. The two heater halves, which were mounted on a rail system, were then retracted. This was followed by the jettison of the two shroud halves into catch nets positioned at 90 deg to the heater rails. The condition which made this test unique compared to the planned subsequent tests was the location of the maximum thermal line at 32 deg from the shroud separation plane. Information on the test hardware, configuration, and sequence is presented. Shroud thermal and deflection data encountered during the heating portion of the test sequence is compared with free-skin design temperatures in various graphical formats. Author

N74-16979*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Analysis Div.

TRACKING SYSTEM ANALYTIC CALIBRATION ACTIVITIES FOR THE MARINER MARS 1971 MISSION

G. A. Madrid, C. C. Chao, H. F. Fliegel, R. K. Leavitt, N. A. Mottinger, F. B. Winn, R. N. Wimberly, K. B. Yip, and J. W. Zielenbach 1 Mar. 1974 105 p refs
(Contract NAS7-100)
(NASA-CR-136826; JPL-TR-32-1587) Avail: NTIS HC $8.25
CSCL 14B

Data covering various planning aspects of Mariner Mars 1971 mission are summarized. Data cover calibrating procedures for tracking stations, radio signal propagation in the troposphere, effects of charged particles on radio transmission, orbit calculation, and data smoothing. For individual titles, see N74-16980 through N74-16986.

N74-16980* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE TRACKING SYSTEM ANALYTIC CALIBRATION ACTIVITY FOR MARINER MARS 1971: ITS FUNCTION AND SCOPE

G. A. Madrid *In its* Tracking System Analytic Calibration Activities for the Mariner Mars 1971 Mission 1 Mar. 1974 p 1-12 refs (For availability see N74-16979 08-11)
CSCL 14B

The functions of the Tracking System Analytic Calibration activity for Mariner Mars 1971 (MM'71), its objectives for this and future missions, and the support provided to the MM'71 Navigation Team during operations are described. Support functions encompass calibration of tracking data by estimating physical parameters whose uncertainties represent limitations to navigational accuracy, and detailed analysis of the tracking data to uncover and resolve any anomalies. Separate articles treat the activities and results of producing calibrations for the various error sources: Deep Space Station Locations, timing and polar motion, charged particles, and the troposphere. Two other articles are also included discussing the effects of the media error sources on orbit determination and the merits of the smoothing technique used for DRIVID. Author

N74-16981* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

STATION LOCATIONS

N. A. Mottinger and J. W. Zielenbach *In its* Tracking System Analytic Calibration Activities for the Mariner Mars 1971 Mission 1 Mar. 1974 p 13-42 refs (For availability see N74-16979 08-11)
CSCL 14B

The extended process of providing station location estimates for use in orbit determination at launch and during the course of the mission, is outlined. Station location sets provided for Mariner Mars 1971 navigation support are given. Data cover set construction, basis for construction, and a comparison of estimated sets with final sets. Author

N74-16982* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

CHARGED PARTICLES

G. A. Madrid *In its* Tracking System Analytic Calibration Activities for the Mariner Mars 1971 Mission 1 Mar. 1974 p 43-60 refs (For availability see N74-16979 08-11)
CSCL 14B

Calibrations compensating for the effects of charged particles in the ionosphere and in the interplanetary medium were applied to the Doppler tracking data acquired during Mariner 9 missions on a demonstration basis. The combined effects of the space plasma and the ionosphere were measured by a comparison of the range and Doppler observables (Differenced Range Versus Integrated Doppler (DRVID). Independent measurements of the ionospheric effects were obtained from polarimeter devices located at the Goldstone, California, tracking complex. Author

N74-16983* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THE TROPOSPHERIC CALIBRATION MODEL FOR MARINER MARS 1971 **c07**

C. C. Chao *In its* Tracking System Analytic Calibration Activities for the Mariner Mars 1971 Mission 1 Mar. 1974 p 61-76 refs (For availability see N74-16979 08-11)
CSCL 17B

The effects of the troposphere on arrival time, range, and range rate measurement of radio signals propagating from spacecraft are examined. A tropospheric calibration model which takes into account seasonal variations, various elevations, and apparent location changes was developed. A comparison was made of the effects before and after calibration. Without calibration, a 16-m change in the distance off the spin axis, is induced for a 10-deg minimum elevation symmetrical pass. Even after calibration with the old model, the error in spin axis is still greater than 1 m. Calibration results and estimated uncertainties of the model are given in tabular form. Test results also show that the model met the required accuracy for the Mariner Mars 1371 mission. Author

N74-16984* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TIME AND POLAR MOTION

H. F. Fliegel and R. N. Wimberly *In its* Tracking System Analytic Calibration Activities for the Mariner Mars 1971 Mission 1 Mar. 1974 p 77-82 refs (For availability see N74-16979 08-11)
CSCL 14B

The time and polar motion calibration support provided to the MM'71 mission is discussed. Specifically, a description is given of the data gathering system and the data processing system by which calibrations were obtained. An introductory discussion of the effects of timing and polar motion error on spacecraft navigation, along with a description of the system used to support Mariners 6 and 7, is given. A complete discussion of the way in which timing is used in orbit determination is also given. Author

N74-16985* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

CALIBRATION EFFECTS ON ORBIT DETERMINATION

G. A. Madrid, F. B. Winn, J. W. Zielenbach, and K. B. Yip *In its* Tracking System Analytic Calibration Activities for the Mariner Mars 1971 Mission 1 Mar. 1974 p 83-96 refs (For availability see N74-16979 08-11)
CSCL 14B

The effects of charged particle and tropospheric calibrations on the orbit determination (OD) process are analyzed. The calibration process consisted of correcting the Doppler observables for the media effects. Calibrated and uncalibrated Doppler data sets were used to obtain OD results for past missions as well as Mariner Mars 1971. Comparisons of these Doppler reductions show the significance of the calibrations. For the MM'71 mission, the media calibrations proved themselves effective in diminishing the overall B-plane error and reducing the Doppler residual signatures. Author

N74-16986* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

POLYNOMIAL SMOOTHING OF DRVID DATA

R. K. Leavitt *In its* Tracking System Analytic Calibration Activities for the Mariner Mars 1971 Mission 1 Mar. 1974 p 97-103 refs (For availability see N74-16979 08-11)
CSCL 14B

Charged particle calibrations based on differenced range versus integrated Doppler (DRVID) are smoothed and fitted with a polynomial prior to its application in the orbit determination process. A description is given of the results of the tests performed on the computer program performing these calculations to

determine its characteristics and to evaluate the acceptability of its computations. This program, called MEDIA, is described. Author

N74-16987# Advisory Group for Aerospace Research and Development, Paris (France).
PROBLEMS OF WIND TUNNEL DESIGN AND TESTING
Dec. 1973 179 p refs Mostly in ENGLISH; partly in FRENCH
(AGARD-R-600) Avail: NTIS HC $12.00

The design and operation of low speed and transonic wind tunnel are discussed. Emphasis is placed on possible future large wind tunnels for Europe. The subjects discussed are: (1) transonic Ludwieg tube wind tunnel, (2) system for generation of quiet transonic flows for model testing at high Reynolds number, (3) the injector driven wind tunnel, and (4) facilities for aerodynamic testing at hypersonic speed. For individual titles, see N74-16988 through N74-16993.

N74-16988 Royal Aircraft Establishment, Farnborough (England).
SOME CONSIDERATIONS OF FUTURE LOW-SPEED TUNNELS FOR EUROPE
A. Spence and B. M. Spee (Natl. Aero- and Astronaut. Res. Inst., Amsterdam) *In* AGARD Probl. of Wind Tunnel Design and Testing Dec. 1973 10 p Prepared in cooperation with Natl. Aero- and Astronaut. Res. Inst., Amsterdam (For availability see N74-16987 08-11)

Two series of possible future low-speed windtunnels have been studied. The first series are high-Reynolds-number tunnels having a product of working section width in metres and maximum pressure in atmospheres kept constant at a value of 45, but including in addition a 60m atmospheric tunnel. The second series comprises atmospheric tunnels of widths ranging from 8m to 25m, and these are of more modest cost and generally lower capability than the first series. Very broad estimates of possible capital and running costs are given as an indication of the scale of expenditure which might be involved; no precise quotations have been obtained. Brief statements are made of the capabilities of the tunnels considered. Each series in turn appears to offer attractive possibilities for future provision of low-speed tunnels in Europe. Author

N74-16989 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Stroemungsmechanik.
PROJECT STUDY OF A LARGE EUROPEAN TRANSONIC LUDWIEG TUBE WINDTUNNEL
H. Ludwieg, H. Grauer-Carstensen, and W. Lorenz-Meyer *In* AGARD Probl. of Wind Tunnel Design and Testing Dec. 1973 22 p refs (For availability see N74-16987 08-11)

A study of a transonic Ludwieg Tube wind tunnel is presented. For a reliable extrapolation of windtunnel measurements to full-scale flight conditions of modern aircraft, a realistic simulation of flight Reynolds numbers at transonic speeds becomes increasingly important. It is shown, how the need for a high Reynolds number experimental facilitity can be satisified by a Ludwieg Tube tunnel. The Ludwieg Tube is characterized by its unsurpassed simplicity which guarantees a high degree of reliability. Design data, dimensions, and cost estimates for the described tube wind tunnel are presented. The basic facility characteristics are given. Author

N74-16990 Royal Aircraft Establishment, Bedford (England).
THE DEVELOPMENT OF AN EFFICIENT AND ECONOMICAL SYSTEM FOR THE GENERATION OF QUIET TRANSONIC FLOWS SUITABLE FOR MODEL TESTING AT HIGH REYNOLDS NUMBER
P. G. Pugh *In* AGARD Probl. of Wind Tunnel Design and Testing Dec. 1973 17 p refs (For availability see N74-16987 08-11)

Current work on the development of the ECT drive system is reviewed. It is shown that this is a particularly economical and effective means of providing a radical improvement in the Reynolds numbers at which transonic, wind-tunnel tests can be performed. Experimental trails which confirmed the practicability of the essential features of this system are described, and the problems of optimizing the design of a particular wind-tunnel are discussed. Author

N74-16991 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE INJECTOR DRIVEN TUNNEL
Pierre Carriere *In* AGARD Probl. of Wind Tunnel Design and Testing Dec. 1973 56 p refs (For availability see N74-16987 08-11)

The development and characteristics of an injector driven wind tunnel are described. The subjects discussed are: (1) methods for evaluating and optimizing the performance in steady continuous flow, (2) analysis of unsteady phenomena during the wind tunnel start, and (3) problems of intense noise generated by the jets. Indications on the orders of magnitude of basic technological data. Sketches of the active part of the induction driven tunnel and a graph of the thermodynamic cycle are presented. Author

N74-16992 Institut Aerotechnique de Saint-Cyr, Saint-Cyr-l'Ecole (France).
HYDRAULIC COMPRESSOR WIND TUNNEL [SOUFFLERIE A COMPRESSEUR HYDRAULIQUE]
Maurice Menard and Francis Chometon *In* AGARD Probl. of Wind Tunnel Design and Testing Dec. 1973 28 p refs In FRENCH (For availability see N74-16987 08-11)

A description is given of a motor system for transonic wind tunnels with large Reynolds numbers. The installation and its functions were also described. Theoretical studies were made of thermodynamic cycles based on the possible evolution of power absorbed by the installation. Data are also given on the economics of the wind tunnel project, technological solutions proposed, and proper reservoir construction. Transl. by E.H.W.

N74-16993 National Aerospace Lab., Amsterdam (Netherlands).
FACILITIES FOR AERODYNAMIC TESTING AT HYPERSONIC SPEEDS
F. Jaarsma and W. B. DeWolf *In* AGARD Probl. of Wind Tunnel Design and Testing Dec. 1973 40 p refs (For availability see N74-16987 08-11)

An assessment is made of the usefulness and potential of existing European hypersonic facilities, on the basis of the planned U.S. space shuttle project and a hypothetical hypersonic transport aircraft. With respect to aerodynamic testing of space shuttle type of vehicles it is pointed out that a significant gap exists between M = 10 and M = 15. At low-hypersonic Mach numbers the facilities in Europe will generally meet the minimum requirements for testing hypersonic transport models. European capabilities appear to be rather similar to those in the U.S. hypersonic wind tunnels, though the U.S. capabilities will be increased considerably in the near future. It is further concluded that European facilities fall short in their performance of what is required, in the field of propulsion (including supersonic combustion tests) and also of hardware testing. Author

N74-16994*# Scientific Translation Service, Santa Barbara, Calif.
THE DESIGN AND CONSTRUCTION OF AN ANECHOIC CHAMBER LINED WITH PANELS FOR INVESTIGATION OF AERODYNAMIC NOISE
J. P. Berhault, M. Sunyach, H. Arbey, and G. Comte-Bellot Washington NASA Jan. 1974 22 p Transl. into ENGLISH from Acustica (West Germany), v. 29, no. 2, 1973 2 p 69-78 (Contract NASw-2483)
(NASA-TT-F-15243) Avail: NTIS HC $4.25 CSCL 14B

The wall lining of the chamber consists of successive layers of glass wool panels, of densities 70 kg/cu m and 38 kg/cu m. The former are 80 cm long, the latter, 40, 50, 60 or 70 cm long. The dimensions of the open space in the chamber are: 6.10 m (length) x 4.60 m (width) x 3.80 m (height). The acoustic characteristics of the chamber were examined by measuring the sound pressure level p as a function of the distance r from different sources. The deviations from the decay law are apparent principally in the region of 80 Hz, where p decreases too rapidly, and for surveys near the walls, where the decay is frequently dependent. An air stream is ducted into the chamber for investigations of aerodynamic noise. The dimensions of the

free jet in the nozzle plane are 30 cm x 10 cm. The maximum jet velocity is 60 m/sec. Author

N74-16995*# American Airlines, Inc., Tulsa, Okla.
FLIGHT EVALUATION OF TWO SEGMENT APPROACHES FOR JET TRANSPORT NOISE ABATEMENT
Robert A. Rogers, Bernard Wohl, and C. M. Gale Jun. 1973 180 p refs
(Contract NAS2-6501)
(NASA-CR-114735) Avail: NTIS HC $12.00 CSCL 20A

A 75 flight-hour operational evaluation was conducted with a representative four-engine fan-jet transport in a representative airport environment. The flight instrument systems were modified to automatically provide pilots with smooth and continuous pitch steering command information during two-segment approaches. Considering adverse weather, minimum ceiling and flight crew experience criteria, a transition initiation altitude of approximately 800 feet AFL would have broadest acceptance for initiating two-segment approach procedures in scheduled service. The profile defined by the system gave an upper glidepath of approximately 6 1/2 degrees. This was 1/2 degree greater than inserted into the area navigation system. The glidepath error is apparently due to an erroneous along-track, distance-to-altitude profile. Author

N74-16996# Rocket Propulsion Establishment, Westcott (England).
THE PRODUCTION OF LIQUID HYDROGEN AT THE ROCKET PROPULSION ESTABLISHMENT
R. Bainbridge and T. R. Horton Dec. 1971 60 p refs
(RPE-TR-71/17; BR36685) Avail: NTIS HC $6.00

The design, development and operation of a liquid hydrogen plant with an hourly output of 100 liters of normal liquid hydrogen or 70 liters of 85-90 per cent parahydrogen are described. In a period of six months over 40,000 liters of 85-90 per cent parahydrogen was produced, most of which was used in support of ELDO projects. The performance of a pre-cooled Linde cycle is examined and the major design concepts required to ensure a safe reliable production facility are discussed. ESRO

N74-16997# Calspan Corp., Buffalo, N.Y.
X-22A FIXED-BASE GROUND SIMULATOR FACILITY Final Report
T. J. Gavin and R. D. Till Oct. 1973 42 p refs
(Contract N00019-72-C-0380)
(AD-769942; CALSPAN-AK-5113-F-1) Avail: NTIS CSCL 01/3

The report presents a description of the X-22A fixed-base ground simulator facility. The simulation will be used in conjunction with the X-22A V/STOL aircraft which is a unique research tool used in performing flying qualities research. The simulator duplicates the X-22A aircraft and its systems for varying pertinent pitch, roll, yaw and thrust stability derivatives. . A high-speed process control digital computer is used to solve the X-22A equations of motion including the nonlinear characteristics associated with transition, and provides the signals for the displays and variable stability system. The X-22A ground simulator is a facility that consists of an air conditioned flight simulation cockpit and a mobile van. (Modified author abstract) GRA

N74-16998# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
AN INVESTIGATION OF THE STRUCTURAL PROPERTIES OF STABILIZED LAYERS IN FLEXIBLE PAVEMENT SYSTEMS Technical Report, Feb. 1971 - Aug. 1973
W. R. Barker, W. N. Brabston, and F. C. Townsend Oct. 1973 166 p refs
(Contract F29601-71-X-0008; AF Proj. 683M)
(AD-769292; AFWL-TR-73-21) Avail: NTIS CSCL 01/5

In recent years mechanistic models have been advocated as a tool for predicting the performance of pavement systems under aircraft traffic. In the investigation reported herein, layered elastic and nonlinear finite element models were used to determine the benefit of stabilized layers within a pavement system. The performance of several types of pavement structures that were constructed and trafficked under controlled conditions at the U.S. Army Engineer Waterways Experiment Station were analyzed with respect to predicted response, measured response, and manifestation of traffic distress in the pavement systems. From the analysis, relationships were developed between pavement life and predicted response such that the benefit of the use of stabilized materials within a pavement system could be examined based on the influence which the material would have on the predicted life of the pavement system. Author (GRA)

N74-16999# Air Force Weapons Lab., Kirtland AFB, N.Mex.
EVALUATION OF RUNWAY SKID RESISTANCE CHARACTERISTIC AT ROYAL AIR FORCE BENTWATERS Final Report, 1 Nov. 1972 - 30 Jun. 1973
George D. Ballentine and Phil V. Compton Nov. 1973 36 p
(AF Proj. 683M)
(AD-770019; AFWL-TR-73-206) Avail: NTIS CSCL 01/5

Data gathered during the Air Force Weapons Laboratory standard skid-resistance test conducted at Royal Air Force Bentwaters, England, on 24 November 1972, are analyzed. Results indicate the runway surface had good skid-resistance properties and no corrective action was indicated at the time of the test. Author (GRA)

N74-17000# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DEVELOPMENT OF A RESPONSIVE TARGET FOR TRACKING TASKS IN THE DYNAMIC ENVIRONMENTAL SIMULATOR M.S. Thesis
Robert P. Barrett Jun. 1973 165 p refs
(AD-769925; GA/MC/73-2) Avail: NTIS CSCL 15/7

Research was conducted to determine whether any of the available air-to-air combat simulations could be readily adapted to the need for a responsive target in the dynamic environmental simulator. Computer subroutines were written to make logical role and tactics decisions based on relative aircraft states, to make variations in decision parameters corresponding to differences in pilots, to provide desired control inputs to implement the role and tactics decision, and to provide for finite control rates. A test program was written incorporating the differential equations of motion of the simulated target. The equations of state of the opposing vehicle were included in the test program. Four sets of initial conditions and target flight paths were run, each involving three different pilot skill levels. The results were evaluated to determine the validity of the programmed target. Author (GRA)

N74-17001# Cincinnati Univ., Ohio.
RESEARCH AND DESIGN OF A SEVENTY-SIX (76) FOOT SPAN AIRCRAFT MAINTENANCE HANGER WITH QUARTER SHELL ENDWALLS Final Technical Report, 21 Dec. 1971 - 1 Feb. 1973
David L. Hunt, Jack R. Farrah, and James M. Alexander Jul. 1973 225 p refs
(Contract F33615-71-C-1173; AF Proj. 437A)
(AD-770299; ASD-TR-73-31) Avail: NTIS CSCL 15/5

A lightweight, one hundred percent recoverable air-transportable maintenance hangar to accommodate all current Air Force fighter aircraft (F-15, F-111, F-106, A-9, A-10, F-4). The design is specifically for use as part of the inventory of mobility equipment. Major design features are the employment of no-thru metal panels, containerization of the entire structure for transport and the use of folding shell endwalls which provide maximum entry and egress clearances. (Modified author abstract) GRA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-17002 Illinois Inst. of Tech., Chicago.
SIMILARITY SOLUTIONS OF FLOWS IN ANNULI WITH ROTATING PERMEABLE WALLS Ph.D. Thesis
Josette Morel 1973 138 p
Avail: Univ. Microfilms Order No. 73-27065

An exact solution to the incompressible axisymmetric

Navier-Stokes equations was obtained for the case of flow in a rotating uniformly porous annulus with a very large length to diameter ratio. Based on the assumptions that the radial and tangential velocity profiles are independent of the axial location, the equations reduce to a system of nonlinear ordinary differential equations with two-point boundary conditions. These equations yield similar solutions where all radial and tangential profiles and all shapes of the axial profiles are independent of the axial location. A new method of solution was devised and successfully applied. Through a parametric differentiation of the original system the boundary value problem is converted into a large system of initial value problems with the parameters as the independent variable. The method is general and can be applied to any other problem the modeling of which results in ordinary nonlinear differential equations with two-point boundary conditions.
Dissert. Abstr.

N74-17003 Purdue Univ., Lafayette, Ind.
ANALYSIS OF DUCTED AXISYMMETRIC JET FLOWS WITH CONDENSED PHASES AND COMBUSTION Ph.D. Thesis
James Ralph Hofmann 1973 235 p
Avail: Univ. Microfilms Order No. 73-28086

A multifluid theory for turbulent multiphase flow with chemical reactions in a duct of circular cross section is developed. The equations of motion for the gas flow are obtained by adding terms to the classical boundary layer equations for multicomponent reacting flow to account for possible interactions among the phases. The equations for the particle fluid, considered as a continuum, are developed from a form of the collisionless Boltzmann equation. The effects of particle chemistry are included through use of the internal energy, radius, and oxide mass fraction of the particle as state variables for the particle. Lateral motion of the particle cloud is assumed to arise from a turbulent gradient diffusion process. Particles are treated as one component and the gas the second component of a binary mixture and the binary mass diffusion equation for turbulent flow is used in place of the radial momentum equation for the particle flow.
Dissert. Abstr.

N74-17004 California Univ., Los Angeles.
PRESSURE CROSS-CORRELATIONS IN THE INVESTIGATION OF AERODYNAMIC NOISE FROM JETS Ph.D. Thesis
Patrick Mongrolle Hurdle 1973 178 p
Avail: Univ. Microfilms Order No. 73-28714

Cross correlation techniques were employed to investigate the noise generating source distribution for a subsonic free jet. The cross correlation measurement was the basis for the calculation of a Q-function, which is defined as the fraction (per unit volume) of the mean square far field sound pressure originating in a particular region within the turbulent volume. Employing this Q-function, the source distributions of a free jet at two different jet exit velocity are quantitatively described. To examine the validity of this technique employed, the Q-function was integrated over a reasonable turbulent volume. The integration showed good agreement with the theory. The results of this experiment showed that the turbulent volume mainly responsible for the noise generated is confined to a rather limited cylindrical volume centered about the jet axis in the vicinity of the end of the potential core region with a length of approximately six jet diameters. Dissert. Abstr.

N74-17005 Catholic Univ. of America, Washington, D.C.
THE LAMINAR BOUNDARY LAYER ON A BLUNT BODY OF REVOLUTION AT ANGLE OF ATTACK Ph.D. Thesis
Woo Taik Moon 1973 114 p
Avail: Univ. Microfilms Order No. 73-25149

The prediction of the points of instability, transition and separation presented together with the calculation of the incompressible laminar boundary layer properties on windward and leeward meridians of a hemispheric nosed body of revolution at angles of attack, alpha = 0 deg, 10 deg, 15 deg and 20 deg using an experimental pressure distribution. The three-dimensional solution for the boundary layer equations was obtained using a finite difference method. The prediction of the instability and transition points was made utilizing semi-empirical methods over a range of Reynolds numbers 100000 < or = Re infinity < or = 10 to the 8th power. The results indicate that the instability of the flow moves from the region of adverse pressure gradient into the region of favorable pressure gradient as the Reynolds number increases from 100000 to 10 to the 8th power. An attached vortex region is notices before the separation on the leeward meridian, however this disappears at alpha = 20 deg. Dissert. Abstr.

N74-17006 Arizona Univ., Tucson.
AN INVESTIGATION OF THE INFLUENCE OF A FORWARD EJECTED GAS STREAM IN HYPERSONIC FLOW ABOUT BODIES Ph.D. Thesis
Frederick Francis Tolle 1973 225 p
Avail: Univ. Microfilms Order No. 73-30249

A blunted diamond airfoil with a supersonic jet in its leading edge was tested in Mach 14 flow to determine jet influence on aerodynamic coefficients. Tests were run at various angles of attack, jet mass flow rates, and free stream Reynolds numbers, and pressure data were obtained. An inverse calculation based on schlieren photographs was used to obtain pressure and velocity data in the nose region which could not be instrumented. Pressure data were integrated to obtain lift, drag, and moment coefficients. Near the leading edge, bluntness and injection rate both influenced pressure. At low mass injection rates, the jet flow extended only a short distance upstream, forming a relatively blunt obstacle to the free stream. A successful correlation of pressure data near the leading edge for the blunt interaction was found through the use of the viscous hypersonic interaction parameter and the hypersonic similarity parameter and was independent of injection rates. Dissert. Abstr.

N74-17007 Georgia Inst. of Tech., Atlanta.
A TURBULENT BOUNDARY LAYER WITH SLOT INJECTION OF DRAG REDUCING POLYMER Ph.D. Thesis
Dermot Joseph Collins 1973 184 p
Avail: Univ. Microfilms Order No. 73-29023

An experimental study involving velocity profile and polymer concentration measurements was made in a developing channel boundary layer. Pure water and aqueous solutions of Poly (ethylene oxide), Polyox WSR-301, of 500, 1000, and 2000 ppm were injected into the boundary layer downstream from the origin through two rows of holes at an angle of 15 deg with the plate. Velocity profiles were measured with a pitot tube. Wall shear stress data for the pure water boundary layer were obtained using the law of the wall. The presence of PEO caused large errors in velocity measurements close to the wall. Consequently, the law of the wall method could not be applied to compute wall shear. The pure water velocity defects were plotted for all four test stations. The results showed that the flow approximated an equilibrium turbulent boundary layer.
Dissert. Abstr.

N74-17008 Engineering Sciences Data Unit, London (England).
FLUID FORCES, PRESSURES AND MOMENTS ON RECTANGULAR BLOCKS
Jul. 1973 4 p Sponsored by Roy. Aeron. Soc., Inst. of Chem. Eng., Inst. of Mech. Eng., and Inst. of Structural Eng.
(ESDU-71016-Amend-A-Amend-B) Copyright. Avail: Issuing Activity

An investigation was conducted to determine the pressure distribution on the faces of a cube immersed in a two dimensional fluid flow. The effect of inclination angle of the block on the pressure gradients is represented for angles of 15, 30, and 45 deg. The data are presented in the form of isobaric curves for each face of the cube. P.N.F.

N74-17009 Engineering Sciences Data Unit, London (England).
PERFORMANCE OF CONICAL DIFFUSERS IN INCOMPRESSIBLE FLOW
Oct. 1973 24 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-73024) Copyright. Avail: Issuing Activity CSCL 20D

Information on the static-pressure recovery, total-pressure loss, and overall flow pattern for flow through straight-axis conical diffusers is presented. The effects of various geometrical and flow parameters on the diffuser performance are discussed. A drawing of the geometry of a typical diffuser and its associated ductwork is included. Mathematical models are developed to

show: (1) the principal geometric parameter relationships, (2) the static-pressure recovery coefficient, and (3) the total-pressure loss coefficient. Author

N74-17010 Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
THE STRATEGY OF CALCULATION METHODS FOR COMPLEX TURBULENT FLOWS
P. Bradshaw Aug. 1973 59 p refs
(IC-Aero-73-05) Avail: NTIS HC $6.00

A calculation method for complex flows is outlined. It is pointed out that at present such methods are not likely to be applicable to all flows without change in empirical input. Numerical problems are discussed. Rules for cheating the computer by marching elliptic problems and otherwise treating unknown quantities as known, are considered to be urgently needed. Author (ESRO)

N74-17011*# National Aeronautics and Space Administration, Washington, D.C.
AERODYNAMICS OF RAREFIED GASES
S. V. Vallander, ed. Feb. 1974 349 p refs Transl. into ENGLISH of the publ. "Aerodinamika Razrezhennykh Gazov" Leningrad, Leningrad State Univ. Press, 1969 p 1-198 Sponsored in part by NASA
(NASA-TT-F-15405; TT-71-53149) Avail: NTIS HC $19.50 CSCL 20D

The interaction of gases with surfaces, the free molecular flow around flat bodies, the aerodynamical problems in the rarefied plasma, and the theoretical experimental studies in the intermediate zone are discussed. Together with the investigation of the theoretical models, a prominant place is given to the mathematical solutions of a number of definite problems. Author

N74-17012# Queens Univ., Kingston (Ontario). Dept. of Mechanical Engineering.
RESPONSE FUNCTIONS FOR PITOT PROBES IN TURBULENT STREAMS
H. A. Becker and A. P. G. Brown May 1972 130 p refs Sponsored by Natl. Res. Council of Canada
(Rept-2-72) Avail: NTIS HC $8.50

The application of numerical methods for determining pitot probe response in turbulent streams is discussed. The principal function of the numerical analysis is an error integral. The functions are defined and numerical results of computations are presented tabularly and graphically. The mathematical tables are suitable for mean velocity measurements in turbulent flows and especially for measurement of turbulence intensity. Author

N74-17013*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE COMPUTATION OF STEADY NOZZLE FLOW BY A TIME-DEPENDENT METHOD
Michael C. Cline (Los Alamos Sci. Lab.) Apr. 1974 20 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Apr. 1974
(NASA-TM-X-71918) Avail: NTIS HC $4.00 CSCL 20D

The steady flow in two-dimensional and axisymmetric nozzles was computed using a time-dependent method. In this method the interior mesh points were computed using the MacCormack finite-difference scheme, while a characteristic scheme was used to calculate the boundary mesh points. No explicit artificial viscosity term was included. The fluid was assumed to be a perfect gas. This method was used to compute the flow in a 45 deg - 15 deg conical, converging-diverging nozzle, a 15 deg conical, converging nozzle, and a 10 deg conical, plug nozzle. Good agreement between the numerical solution and experimental data was found. In contrast to previous time-dependent methods, the computational times were less than one minute on a CDC 6600 computer. Author

N74-17014*# Bucknell Univ., Lewisburg, Pa.
PARTICLE FLOW IN BLADE PASSAGES OF TURBOMACHINERY WITH APPLICATION TO LASER-DOPPLER VELOCIMETRY Final Report
Barry R. Maxwell Feb. 1974 36 p refs
(Grant NGR-39-027-002)
(NASA-CR-134543) Avail: NTIS HC $4.00 CSCL 20D

A theoretical analysis was conducted of the dynamic behavior of micron size particles entrained in gas flow on the two-dimensional blade-to-blade surface of a circular stationary cascade of turbine stator blades. The particle velocity lag and angular deviation relative to the gas was determined as a function of particle diameter and mass density. Particles size and density were varied over ranges selected to correspond to typical laser-Doppler velocimeter (LDV) flow field mapping applications. It was found that velocity lag and angular deviation increased whenever particle size or mass density increased, and that particle tracking was more sensitive to a change in particle diameter than to a change in mass density. Results indicated that LDV applications employing 1 gm/cc tracer particles with diameters greater than approximately 1 micron, or 0.5 micron diameter particles with mass densities greater than 4 gm/cc would experience velocity and angular deviations generally greater than 2 percent and 1 degree, respectively. Author

N74-17015*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR QUASI-ONE-DIMENSIONAL COMPRESSIBLE FLOW WITH AREA CHANGE AND FRICTION - APPLICATION TO GAS FILM SEALS
John Zuk and Patricia J. Smith Washington Feb. 1974 86 p refs
(NASA-TN-D-7481; E-7241) Avail: NTIS HC $3.75 CSCL 20D

A computer program is presented for compressible fluid flow with friction and area change. The program carries out a quasi-one-dimensional flow analysis which is valid for laminar and turbulent flows under both subsonic and choked flow conditions. The program was written to be applied to gas film seals. The area-change analysis should prove useful for choked flow conditions with small mean thickness, as well as for face seals where radial area change is significant. The program is written in FORTRAN 4. Author

N74-17016*# Case Western Reserve Univ., Cleveland, Ohio.
ANALYSIS OF LAMINAR FLOW BETWEEN STATIONARY AND ROTATING DISKS WITH INFLOW Final Report
Upendra Rohatgi and Eli Reshotko Washington NASA Feb. 1974 119 p refs
(Grant NGL-36-003-139)
(NASA-CR-2356; FTAS/TR-73-85) Avail: NTIS HC$4.50 CSCL 20D

The laminar flow between a rotating and a stationary disk with inflow was analyzed. Solutions to the dimensionless governing equations are sought by expanding each of the velocity components in powers of inverse radius. The equations to leading order are those for the configuration with no inflow. The subsequent orders yield sets of linear ordinary differential equations. Solutions are obtained for the first two of these subsequent orders. The solutions indicate that inflow tends to increase the magnitude of the azimuthal velocity in the flow between the two disks and to decrease the torque on the rotating disk. For Prandtl number one, an energy integral is obtained which relates the temperature distribution to the velocity distribution for all Reynolds numbers and therefore eliminates the needs for separate solution of the energy equation. Author

N74-17017*# Alabama Univ., Huntsville.
CALCULATION OF EDDY VISCOSITY IN A COMPRESSIBLE TURBULENT BOUNDARY LAYER WITH MASS INJECTION AND CHEMICAL REACTION, VOLUME 1 Final Report
Satoaki Omori Dec. 1973 102 p refs
(NASA-CR-129019-Vol-1) Avail: NTIS HC $8.25 CSCL 20D

The turbulent kinetic energy equation is coupled with boundary layer equations to solve the characteristics of compressible turbulent boundary layers with mass injection and combustion. The Reynolds stress is related to the turbulent kinetic energy using the Prandtl-Wieghardt formulation. When a lean mixture of hydrogen and nitrogen is injected through a porous plate into the subsonic turbulent boundary layer of air flow and ignited by external means, the turbulent kinetic energy increases twice as much as that of noncombusting flow with the same mass injection rate of nitrogen. The magnitudes of eddy viscosity between combusting and noncombusting flows with injection, however, are almost the same due to temperature effects, while

the distributions are different. The velocity profiles are significantly affected by combustion; that is, combustion alters the velocity profile as if the mass injection rate is increased, reducing the skin-friction as a result of a smaller velocity gradient at the wall. If pure hydrogen as a transpiration coolant is injected into a rocket nozzle boundary layer flow of combustion products, the temperature drops significantly across the boundary layer due to the high heat capacity of hydrogen. At a certain distance from the wall, hydrogen reacts with the combustion products, liberating an extensive amount of heat. The resulting large increase in temperature reduces the eddy viscosity in this region. Author

N74-17018*# Alabama Univ., Huntsville.
CALCULATION OF EDDY VISCOSITY IN A COMPRESSIBLE TURBULENT BOUNDARY LAYER WITH MASS INJECTION AND CHEMICAL REACTION, VOLUME 2 Final Report
Satoaki Omori Dec. 1973 249 p refs
(NASA-CR-129019-Vol-2) Avail: NTIS HC $15.50 CSCL 20D

As described in Vol. 1, the eddy viscosity is calculated through the turbulent kinetic energy, in order to include the history of the flow and the effect of chemical reaction on boundary layer characteristics. Calculations can be performed for two different cooling concepts; that is, transpiration and regeneratively cooled wall cases. For the regenerative cooling option, coolant and gas side wall temperature and coolant bulk temperature in a rocket engine can be computed along the nozzle axis. Thus, this computer program is useful in designing coolant flow rate and cooling tube geometry, including the tube wall thickness as well as in predicting the effects of boundary layers along the gas side wall on thrust performances. Author

N74-17019*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WALL BOUNDARY EQUATIONS WITH SLIP AND CATALYSIS FOR MULTICOMPONENT, NONEQUILIBRIUM GAS FLOWS
Carl D. Scott Dec. 1973 44 p refs
(NASA-TM-X-58111; JSC-08558) Avail: NTIS HC $5.25 CSCL 20D

Boundary equations obtained for a low Reynolds number, high enthalpy gas flow in regions of velocity slip and temperature jump are presented. The formulation treats, through a first-order distribution function used to include multicomponent diffusion, a multicomponent gas mixture that may be in nonequilibrium with finite-rate catalytic recombination occurring on the wall. In the boundary equations, which are obtained for use in flow-field calculations applicable to low-density flow regimes, a simplified gas/wall interaction is assumed wherein individual atoms or molecules either reflect specularly off the wall or stick and are fully accommodated. Fluxes in terms of evaluated integrals over the distribution function and integrals necessary for determining fluxes are given. Author

N74-17020*# Remtech, Inc., Huntsville, Ala.
THREE DIMENSIONAL LASER DOPPLER VELOCIMETER TURBULENCE MEASUREMENTS IN A PIPE FLOW
Charles E. Fuller, III, William C. Cliff (NASA. Marshall Space Flight Center), and Robert M. Huffaker Apr. 1973 95 p refs (Contract NAS8-25896)
(NASA-CR-129017; RTR-002-2) Avail: NTIS HC $7.75 CSCL 20D

The mean and turbulent u, v, and w components of a gaseous fully developed turbulent pipe flow were measured with a laser Doppler velocimeter system. Measurements of important system parameters are presented and discussed in relation to the measurement accuracy. Simultaneous comparisons of the laser Doppler and hot wire anemometer measurements in the turbulent flow provided evidence that the two systems were responding to the same flow phenomena. Author

N74-17021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL CALCULATIONS OF TWO DIMENSIONAL, UNSTEADY TRANSONIC FLOWS WITH CIRCULATION
Richard M. Beam and R. F. Warming Washington Feb. 1974 29 p refs
(NASA-TN-D-7605; A-5265) Avail: NTIS HC $3.25 CSCL 20D

The feasibility of obtaining two-dimensional, unsteady transonic aerodynamic data by numerically integrating the Euler equations is investigated. An explicit, third-order-accurate, noncentered, finite-difference scheme is used to compute unsteady flows about airfoils. Solutions for lifting and nonlifting airfoils are presented and compared with subsonic linear theory. The applicability and efficiency of the numerical indicial function method are outlined. Numerically computed subsonic and transonic oscillatory aerodynamic coefficients are presented and compared with those obtained from subsonic linear theory and transonic wind-tunnel data. Author

N74-17022*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
SURFACE PRESSURE FLUCTUATIONS IN HYPERSONIC TURBULENT BOUNDARY LAYERS Final Report
K. R. Raman Washington NASA Feb. 1974 92 p refs (Contract NAS2-6838)
(NASA-CR-2386) Avail: NTIS HC $4.00 CSCL 20D

The surface pressure fluctuations on a flat plate model at hypersonic Mach numbers of 5.2, 7.4 and 10.4 with an attached turbulent boundary layer were measured using flush mounted small piezoelectric sensors. A high frequency resolution of the pressure field was achieved using specially designed small piezoelectric sensors that had a good frequency response well above 300 KHz. The RMS pressures and non-dimensional energy spectra for all above Mach numbers are presented. The convective velocities, obtained from space time correlation considerations are equal to 0.7 U sub infinity. The results indicate the RMS pressures vary from 5 to 25 percent of the mean static pressures. The ratios of RMS pressure to dynamic pressure are less than the universally accepted subsonic value of 6 x 10/3. The ratio decreases in value as the Mach number or the dynamic pressure is increased. The ratio of RMS pressure to wall shear for Mach number 7.4 satisfies one smaller than or equal to p/tau sub w smaller than or equal to three. Author

N74-17023# Lehigh Univ., Bethlehem, Pa. Dept. of Physics.
AN ANALYTICAL CONSIDERATION OF THE PARTICLE INERTIA EFFECT WITH AN APPLICATION TO AEROSOL SAMPLING EFFICIENCY CALCULATION
Yong Wook Kim Jan. 1974 83 p refs
(Contract DI-BM-GO-110235)
(TR-24) Avail: NTIS HC $7.25

The particle inertia effect in the absence of all other competing effects has been treated analytically with parallel laboratory experiments providing realistic clues necessary in the chain of theoretical development. Expressions for two universal coefficients have been obtained, which give rise sufficiently to quantitative measures of the inertia effect for a variety of given flow fields. Calculations of the particle sampling efficiency in the presence of the pure inertia effect were made. A two-dimensional sampler was chosen as a model system for this purpose. Descriptions for its flow field have been established precisely by first measuring the field with tracer particle method and then comparing the measurement with existing potential theoretic results. A general scheme of computing the number of sampled particles for each specific size category has been established and applied to the model system. Results show that the sampled particle number density exceeds the free stream density as a consequence of readjustment of the particle number density in the sampler inlet region due to the inertia effect. Author

N74-17024# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
FLOW PATTERN INVESTIGATION OF He/Ar AND He/SF6 MIXTURES IN A SEPARATION NOZZLE BY MEANS OF MOLECULAR FLOW PRESSURE PROBES
K. Bier, H. Brandtstadter, U. Ehrfeld, and W. Ehrfeld Jun. 1972 55 p refs Transl. into ENGLISH from West German Rept. KFK-1440
(LIB/Trans-429; KFK-1440) Avail: AEC Depository Libraries

An experimental technique was developed for fundamental investigations of the nozzle separation process. This allows the treatment of local flow and diffusion phenomena in rarefied gas mixtures. Measurments were made of with mixtures of He/Ar and He/SF6 on a large scale model of the separation nozzle.

The results show that a strongly viscous, near sonic flow field exists under operating conditions that correspond to an economically optimized nozzle separation process. The measurements also show that in extensive regions of the flow field the local conditions depart from thermal equilibrium. In this case the local molecular velocity distributions can be represented by two superimposed half - range Maxwellians. Furthermore, the measurements indicate that there is a velocity slip between the various components of the gas mixture in some parts of the flow field. Author

N74-17025# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
TURBULENCE WITH SOLID BODIES [TURBULENZ MIT FESTEN KOERPERN]
H. Reichardt Jun. 1973 36 p refs In GERMAN; ENGLISH summary
(Rept-7/1973) Avail: NTIS HC $5.00; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. 11,60 DM

In order to study the structure of turbulence with unconventional methods, an apparatus was constructed which produces an almost plane turbulent jet flow in a mixture of water and solid cylindrical bodies. The velocities in the jet were measured from time exposure photographs of the cylinders. Results indicate that turbulence with solid bodies may be used to investigate the structure of turbulence. Author (ESRO)

N74-17026# Nielsen Engineering and Research, Inc., Mountain View, Calif.
THEORETICAL ANALYSIS OF CYCLOIDAL PROPELLERS. PART 2: PROGRAM MANUAL Final Report, 1 May 1970 - 30 Jun. 1973
Michael R. Mendenhall and S. B. Spangler 30 Jun. 1973 58 p refs 2 Vol.
(Contract N00014-70-C-0346)
(AD-768911; NEAR-TR-53-Pt-2) Avail: NTIS CSCL 13/10

A computer program has been developed to predict the behavior and performance of a cycloidal propeller assuming two-dimensional flow. Potential flow methods are used and the wake vorticity shed from each blade is approximated by a number of discrete vortices. The interference of the wake on the blades, the blades on the wake, and mutual interference between the blades are considered. The report is a user's manual for the computer program. This program manual contains a description of the use of the program, instructions for preparation of input, a description of the output, a program listing, and sample cases. The theory and comparisons with three-dimensional data are described in Part I of this report. Author (GRA)

N74-17027# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
ON THE MATCHING OF SOLUTIONS FOR UNSTEADY TRANSONIC NOZZLE FLOWS
T. C. Adamson, Jr., A. F. Messiter, and G. K. Richey Sep. 1973 27 p refs Prepared in cooperation with Mich. Univ., Ann Arbor
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)
(AD-770039; SQUID-TR-MICH-11-PU) Avail: NTIS CSCL 20/4

Many solutions have been presented for two dimensional transonic nozzle flows, with several different methods being represented. Two of the more interesting of these solutions are those presented by Tomotika and Tamada (1950) and Szaniawski (1965). However, it has not been made clear under what conditions either solution is valid. It is the purpose of the paper using the methods of matched asymptotic expansions, to derive the Szaniawski power series systematically and to show that this solution should be considered as an outer solution which may not be uniformly valid as the throat is approached. The inner throat region is governed by the nonlinear transonic equations which admit as one class of solutions, similarity solutions. The analysis is performed using the general non-steady inviscid equations of motion, with the steady flow results being derivable as a special case. (Modified author abstract) GRA

N74-17028# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
UNSTEADY RADIAL TRANSONIC FLOW WITH SHOCK WAVES
Martin Sichel (Mich. Univ., Ann Arbor) Sep. 1973 37 p refs Prepared in cooperation with Mich. Univ., Ann Arbor
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)
(AD-770040; SQUID-TR-MICH-12-PU) Avail: NTIS CSCL 20/4

An exact analytical solution has been found for viscous, unsteady, radial source flow near the speed of sound. Shock waves with structure appear naturally as a part of the solution. The solution describes radially accelerating or decelerating shock transitions between the supersonic and subsonic branch of the inviscid solution. Accelerating shocks are found to be weaker than decelerating shocks. Author (GRA)

N74-17029# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FRICTION, HEAT EXCHANGE, AND REMOVAL OF MATERIAL IN THE TURBULENT BOUNDARY LAYER ON A COMPRESSIBLE HIGH-ENTHALPY GAS IN CONDITIONS OF ESSENTIAL NONISOTHERMICITY, BLOWING, AND NEGATIVE PRESSURE GRADIENT
Ye. G. Zaulichnyi 29 Oct. 1973 12 p refs Transl. into ENGLISH from Inst. Teplo- i Massoobmena Akad. Nauk Belorussk. SSR (Minsk) v. 1, 1972 p 41-45
(AD-770006; FTD-HT-23-37-74) Avail: NTIS CSCL 21/8

The report develops a numerical method for determining the ablative characteristic of a rocket motor nozzle liner. GRA

N74-17030# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
STUDIES OF AN INTEGRAL METHOD FOR CALCULATING TIME-DEPENDENT TURBULENT BOUNDARY LAYERS
Gary D. Kuhn (Nielsen Eng. and Res., Inc., Mountain View, Calif.) and Jack N. Nielsen (Nielsen Eng. and Res., Inc., Mountain View, Calif.) Oct. 1973 41 p refs Prepared in cooperation with Nielsen Eng. and Res., Inc., Mountain View, Calif.,
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)
(AD-770043; SQUID-TR-NEAR-2-PU) Avail: NTIS CSCL 20/4

An integral boundary-layer method is examined for its applicability to unsteady turbulent boundary layers. The method employs an analytical velocity profile formulation modeled after the law of the wall and the law of the wake and recently applied successfully to calculation of steady separated turbulent boundary layers. Analytical solutions developed from a small perturbation analysis indicate the method is valid for unsteady flow over a certain range of frequencies. Good comparisons were obtained between the linearized theory and results produced by a finite-difference solution of the complete nonlinear unsteady boundary-layer equations. Examination of the nature of the integral equations in the vicinity of a point of zero wall shear stress indicates that that point does not necessarily correspond to a point of separation in unsteady flow. That result is also consistent with the results of other researchers. Author (GRA)

N74-17031# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
ASYMPTOTIC ANALYSIS OF THE TURBULENT BOUNDARY LAYER WITH ZERO WALL STRESS
William B. Bush (Calif. Univ., La Jolla) and Francis E. Fendell (TRW Systems, Redondo Beach, Calif.) Oct. 1973 32 p refs (Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)
(AD-770044; SQUID-TR-TRW-8-PU) Avail: NTIS CSCL 20/4

The (so-called) continuously separating incompressible turbulent boundary layer, where the impressed pressure gradient is such as to produce zero stress at the wall, is studied by means of second-order closure of the Reynolds time-averaged equations. The closure employs an eddy viscosity which is the product of two properties of the turbulence: the mean turbulent kinetic energy and the local integral scale of the turbulence; each of these properties is described by a transport equation balancing convection, production, diffusion, and dissipation. Limit process expansions are adopted in the limit of large turbulent

Reynolds number to elucidate a two-layer structure. (Modified author abstract) GRA

N74-17032# Ballistic Research Labs., Aberdeen Proving Ground, Md.
WALL HEAT TRANSFER EFFECTS ON SUPERSONIC NOZZLE WALL BOUNDARY-LAYER TEMPERATURE PROFILES
Walter B. Sturek Sep. 1973 20 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-770375; BRL-MR-2328) Avail: NTIS CSCL 20/4

Measurements are reported of the total temperature profile in the turbulent boundary layer on a supersonic tunnel nozzle wall for two values of tunnel total temperature. The resulting two conditions of tunnel wall heat transfer history significantly affected the temperature profiles. The trend of the data is shown to agree with the wall heat transfer history when evaluated in terms of the enthalpy flux deficit. Author (GRA)

N74-17033# California Univ., Los Angeles. Dept. of Physics.
INVESTIGATION OF THE THICKNESS AND CRITICAL VELOCITY OF A MOVING UNSATURATED SUPERFLUID FILM USING DOPPLER SHIFTED THIRD SOUND
Kenneth Louis Telschow Sep. 1973 110 p refs
(Contract N00014-69-A-0200-4014; NR Proj. 384-302)
(AD-770141; TR-36) Avail: NTIS CSCL 20/13

The velocity of third sound waves on a moving unsaturated superfluid film has been measured by the time of flight technique. The thickness of the moving film was probed by the average of the two Doppler shifted velocities. To within experimental precision, no changes in film thickness were observed as the film velocity was increased. Several possible resolutions to this paradox are presented. The maximum observed Doppler shift measured the critical flow velocity. (Modified author abstract) GRA

N74-17034# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
FLOW THROUGH A SUDDEN ENLARGEMENT SUBJECTED TO LARGE AMPLITUDE LOW FREQUENCY AXIAL OSCILLATIONS
D. Rockwell Aug. 1973 59 p refs
(Contract N00014-69-A-0417; Proj. Themis)
(AD-770581; THEMIS-LU-TR-20) Avail: NTIS CSCL 20/4

An experimental investigation was undertaken for the case of flow through a sudden expansion subjected to large amplitude low frequency axial oscillations which formed a standing wave in the receiver duct. Measurements included integrated velocity fluctuation amplitudes and velocity and wall pressure fluctuation amplitudes at the wavemaker frequency. Reattachment of the flow drastically attenuates the fluctuation parameters. Oscilloscope traces show a tendency toward flow relaminarisation during the accelerating phase of the cycle, and a turbulent bursting to high turbulence intensity when the time dependent pressure gradient changes from negative to positive. Author (GRA)

N74-17035# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
INVESTIGATION OF TWO DIMENSIONAL CAVITY DIFFUSERS
Frank D. Stull, Edward J. Curran, and Henry R. Velkoff Oct. 1973 18 p refs
(AF Proj. 3012)
(AD-770571; AFAPL-TR-73-84) Avail: NTIS CSCL 20/4

An investigation was conducted to determine the flow regimes and performance of 2-D cavity diffusers. Water table flow visualization tests were conducted over a wide range of diffuser divergence angles and diffuser length to throat-width ratios. Air flow tests were conducted from Mach numbers of .06 to .6 on a 1/3 scale model to obtain diffuser performance. Results indicate that a single cavity can delay separation in 2-D straight wall diffusers, but that static pressure recovery is reduced. In both tests self-induced resonance was encountered which can be reasonably predicted by a vortex wave interaction model. Author (GRA)

N74-17036# Alabama Univ., Huntsville. Div. of Graduate Programs and Research.
THEORETICAL AND EXPERIMENTAL RESEARCH ON FLUIDIC COMPONENTS AND THRUST VECTOR CONTROL SYSTEMS Final Technical Report, 28 Mar. 1972 - 31 Aug. 1973
Cornelius C. Shih Sep. 1973 122 p refs
(Contract DAAH01-71-C-0600)
(AD-770472) Avail: NTIS CSCL 13/7

The report consists of four sections listed as follows: Performance characteristics of a supersonic fluidic amplifier with extended legs for a secondary injection thrust vector control system; secondary injection thrust vector control using vortex amplifiers; feasibility analysis of holographic techniques for applications to secondary injection TVC systems analysis; and, dynamic responses of pressure outputs resulting from control signal inputs in the operation of a supersonic fluidic amplifier. Author (GRA)

N74-17037# Texas Univ., Austin. Dept. of Mechanical Engineering.
AN EXPERIMENTAL STUDY OF SPILLOVER FLOW FROM A SINGLE FLUID AMPLIFIER RECEIVER
A. J. Healey 1973 7 p refs Presented at ASME Winter Ann. Meeting, Detroit, 11-15 Nov. 1973
(Grant DA-ARO(D)-31-124-73-G115)
(AD-770223; AROD-10927-3-E; Paper-73-WA/Flcs-6) Avail: NTIS MF $1.45; American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, N.Y. 10017 HC $3.00 CSCL 13/7

An experimental study is described of the spillover characteristics of a fluid amplifier receiver. The spillover flow occurs in the form of secondary jet flows which can be either separated or attached to the outside wall of the receiver depending generally on receiver loading, width and power jet offset. In the case of a separated secondary jet condition, rebound angles are measured for various receiver widths and power jet offsets. Spillover flowrates are given for various receiver flows and power jet offset. Author (GRA)

N74-17038# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
THEMIS PROJECT: FLUID AMPLIFIERS Final Technical Report
J. A. Owczarer Aug. 1973 220 p refs
(Contract N00014-69-A-0417)
(AD-770582; THEMIS-LU-TR-21) Avail: NTIS CSCL 13/7

A comprehensive review of the Themis project: Fluid Amplifiers is given together with lists of technical reports, graduate student theses, and publications. Author (GRA)

N74-17039# Naval Ship Research and Development Center, Bethesda, Md.
LAMINAR FLOW PAST BODIES UNDER PERFECT SLIP
Hans J. Lugt Jul. 1973 25 p refs Repr. from Proc. of Symp. Ueber Gas-Oberflaechen-Wechselwirkung, 3-5 May 1972, Meersburg, Lake Constance, Germany
(Contract SR0140301)
(AD-770313; NSRDC-4227) Avail: NTIS CSCL 20/4

Current experience conducted at Dornier System on special solid-surface treatment have prompted a study on the fluid dynamic implications of perfect-slip flow. Numerical results on incompressible fluid flows past thin elliptic cylinders at various angles of attack and at moderate Reynolds numbers show that flow separation, instability, and vortex shedding occur also under the perfect-slip condition. Of particular interest is the generation and spreading of an initial vortex after the abrupt start of an airfoil. The circulation theory of lift for potential flows is also applicable to perfect slip. Thus, lift exists so that flying under perfect slip is possible. Author (GRA)

N74-17040# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF EXTERNAL BURNING ASSISTED PROJECTILE M.S. Thesis
Michael Edmund Naber Sep. 1973 71 p refs
(AD-769827) Avail: NTIS CSCL 19/1

External burning reduces the base drag of a supersonic projectile by increasing the base pressure. Drag reduction is of interest due to the increase in range, decreased time of flight and/or increased impact velocity. Theoretically, the Crocco-Lees

analytical model for base flow is reviewed for axisymmetric flow without heat addition and for planar flow with heat addition. A free jet wind facility has been constructed for simulation of a projectile with heat addition. Heat addition is found to give base thrust and, therefore, provides a method for increasing the performance of a gun system. Author (GRA)

N74-17041# Texas Univ., Austin. Dept. of Mechanical Engineering.
A BASIS FOR COMPUTER MODELLING OF INTERNAL FLOWS IN LAMINAR FLUID AMPLIFIERS
Anthony J. Healey and James A. Nicholson 30 Oct. 1973 42 p refs
(Grant DA-ARO(D)-31-124-73-G115)
(AD-770454; AROD-10927-2-E) Avail: NTIS CSCL 13/7

For design purposes it would be desirable to have a model which would predict the dynamic and/or steady state response of a beam-deflection fluid amplifier. One possible computer model consists of using a finite difference scheme to solve the governing fluid flow equations, which are taken to be the Navier-Stokes equation in terms of vorticity and the continuity equation in terms of stream function. Present work on such a model uses an alternating direction implicit method (ADI) on the vorticity equation and a successive overrelaxation method (SOR) on the stream function equation. (Modified author abstract) GRA

N74-17042# Texas Univ., Austin. Dept. of Mechanical Engineering.
VENT LENGTH EFFECTS ON A PROPORTIONAL FLUID AMPLIFIER
Anthony J. Healey and Edward M. Shipp 30 Sep. 1973 86 p refs
(Grant DA-ARO(D)-31-124-73-G115)
(AD-770455; AROD-10927-1-E) Avail: NTIS CSCL 13/7

A model of a pressure controlled proportional fluid amplifier was designed and constructed to investigate the effects of vent length and supply pressure on the steady state and dynamic response of the device. Six different supply pressures, six vent lengths, and two receiver loadings were considered for the steady state investigation. Steady state gain of the device was seen to increase with increasing vent length for both receiver loadings considered. Supply pressure effects on normalized steady state performance were negligible. (Modified author abstract) GRA

N74-17043# Ballistic Research Labs., Aberdeen Proving Ground, Md.
REVISED THEORY OF VORTEX RINGS. A SIMPLIFIED REVIEW OF THE STATE OF THE ART, WITH ADDENDUM ON PROSPECTS OF USING VORTEX RINGS TO CONVEY TEAR GAS
Serge J. Zaroodny Jun. 1973 93 p refs
(AD-770426; BRL-MR-2305) Avail: NTIS CSCL 20/4

The vortex ring is an essential and ubiquitous phenomenon that has been rather neglected in aerodynamics and technology, perhaps because it is usually construed, unfortunately, as a mere exercise in old-fashioned mathematics. The existing venerable theories of this phenomenon are at once little known, difficult, uncoordinated, insufficient and inconsistent. They are reviewed, modified and combined, and are thus made ready for the long-overdue experimental tests. An essential mathematical preliminary, the theory of straight vortices, is discussed in an appendix. (Modified author abstract) GRA

N74-17044# United Aircraft Corp., East Hartford, Conn. Research Labs.
AN IMPLICIT NUMERICAL METHOD FOR THE MULTI-DIMENSIONAL COMPRESSIBLE NAVIER-STOKES EQUATIONS
W. Roger Briley and Henry McDonald Nov. 1973 56 p refs
(Contract N00014-72-C-0183)
(AD-770224; UARL-M911363-6) Avail: NTIS CSCL 20/14

In an effort to exploit the favorable stability properties of implicit methods and thereby increase computational efficiency by taking large time steps, an implicit finite-difference method for the multidimensional Navier-Stokes equations is presented. The method is based on a fully-implicit backward time difference scheme which is linearized by Taylor expansion about the known time level to produce a set of coupled linear difference equations which are valid for a given time step. To solve these difference equations, the Douglas-Gunn procedure for generating alternating-direction implicit (ADI) schemes as perturbations of fundamental implicit difference schemes is introduced. The resulting sequence of one-dimensional equations can be solved efficiently by standard block-elimination methods. The method is a one-step method, as opposed to a predictor-corrector method, and requires no iteration to compute the solution for a single time step. The stability and accuracy of the method are examined in a three-dimensional application to subsonic flow in a straight duct with rectangular cross section. (Modified author abstract) GRA

N74-17045# Ohio State Univ. Research Foundation, Columbus.
SUMMARY OF A STUDY OF INTERACTIONS OF IONS WITH FLUID FLOWS Final Report, 1 Oct. 1964 - 31 Jan. 1972
Henry R. Velkoff 30 Oct. 1973 20 p refs
(Grant DA-31-124-ARO(D)-246)
(AD-770460; OSURF-1864-17) Avail: NTIS CSCL 20/4

The report covers a series of analytical and experimental investigations on interactions between electrostatic fields and fluid flows and heat transfer. (Modified author abstract) GRA

N74-17046# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF GAS DYNAMIC STRUCTURE AND ELECTRON DISTRIBUTION IN A HIGH-TEMPERATURE SUPERSONIC JET HAVING A SOLID PHASE
Yu. P. Finatev, L. A. Shcherbakov, and V. T. Filin 6 Nov. 1973 10 p refs Transl. into ENGLISH from Teplo i Massoperenos, (USSR), v. 1, no. 1 1972 p 227-231
(AF Proj. G101)
(AD-770439; FTD-HT-23-293-74) Avail: NTIS CSCL 20/4

The report touches on those questions concerning the position of the central shock (the Mach disk) in the first barrel of the jet and the concentration of the electrons in the nozzle section and Mach disk zones. GRA

N74-17047# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PARTICLE PENETRATION INTO PITOT GAUGES IN SUPERSONIC DUSTY FLOWS
Nathan Gerber, David Chou, Raymond Sedney, and Joan Bartos Oct. 1973 37 p refs
(DA Proj. 1W0-62113-A-660)
(AD-770428; BRL-1677) Avail: NTIS CSCL 18/3

Pitot tube gauges located near the ground are used to measure dynamic pressure in large scale blast tests carried out on desert sites. The penetration of dust particles into the interiors of pitot tubes is studied. The particles are in equilibrium with supersonic airflows behind shock waves propagating into still air. This study is part of an overall effort to determine the effect produced by impact of small particles (e.g., dust raised in strong ground level explosions) on the output of sensors in total pressure gauges. Specifically, hemispherical nose and flat nose pitot tubes are treated, and shock waves traveling with Mach numbers ranging from 2.5 to 10.0 are considered. The corresponding overpressures vary from 6.1 to 115.5 atmospheres. (Modified author abstract) GRA

N74-17048# Air Force Academy, Colo.
THE FOODES PROGRAM DESCRIPTION Interim Report
Carl A. Forbrich, Jr. Jul. 1973 22 p refs
(AF Proj. 7905)
(AD-766238; SRL-TR-73-0008) Avail: NTIS CSCL 20/4

An extremely versatile computer program has been developed to solve systems of first order ordinary differential equations. The method of solution is discussed with the program applied to several problems of interest in fluid mechanics. Author GRA

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-17049 Department of Energy, Mines and Resources, Ottawa (Ontario).
RESOURCE SATELLITES AND REMOTE AIRBORNE SENSING FOR CANADA. REPORT NO. 14: REMOTE SENSING DEVICES
Dennis White, ed. and B. H. Nodwell 1971 133 p refs
(M75-2/14) Copyright. Avail: Issuing Activity

Conclusions and recommendations regarding the remote-sensing devices available or under development are presented as a comprehensive compendium of all the significant physical characteristics of remote-sensing devices, together with sketches illustrating their method of operation. This information will be helpful in selecting the most appropriate available system for use and will also guide sensor development into those areas not covered by existing systems. The tables of available equipment are arranged in such a way that comparison of characteristics between sensors is easily made. A brief introduction to each class of sensors is provided, together with a brief description of each system. Author

N74-17050 Wisconsin Univ., Madison.
AN ANALYSIS OF HEAT AND MOISTURE BUDGETS OF THE INVERSION LAYER FOR STEADY STATE CONDITIONS OVER THE ANTARCTIC PLATEAU Ph.D. Thesis
Stephen Andrew Miller 1973 98 p
Avail: Univ. Microfilms Order No. 73-21010

An underlying assumption is that the processes are in a state of equilibrium, a steady state, which implies that local time derivatives of such quantities as temperature and mixing ratio are negligible. An idealized topographical model of the high plateau is considered. With profiles are calculated, and transports of heat, moisture, and mass through the inversion layer are derived. The moisture budget is examined, with specific attention given to the phenomenon of ice crystal precipitation. Over the high plateau a more or less continuous fall of ice crystals from otherwise clear skies has been observed. Steady state profiles of turbulent heat flux are obtained by integration of the heat balance equation for derived vertical distributions of radiative flux divergence, horizontal advection, and adiabatic warming.
Dissert. Abstr.

N74-17051 Stanford Univ., Calif.
LOW FREQUENCY GYRO-SYNCHROTRON RADIO NOISE FROM THE EARTH'S OUTER RADIATION BELT Ph.D. Thesis
Michael S. Frankel 1973 169 p
Avail: Univ. Microfilms Order No. 73-30398

Electrons spiraling along magnetic field lines emit electromagnetic radiation at radio wavelengths via the cyclotron and synchrotron emission processes. Consequently, with the discovery of the Van Allen radiation belts, the possibility of detecting synchrotron radiation from superthermal electrons trapped in these regions has become an important topic of research. Studies, which to the present have been limited to frequencies above 2 MHz, show that the radio noise from these electrons is not easily detected as it is less than the noise generated by galactic and extragalactic sources. The problem of detecting cyclotron and synchrotron noise from these superthermal electrons is analyzed for the frequency range 30 KHz to 300 KHz. Due to the earth's ionosphere, ground based observation of this noise is improbable. Dissert. Abstr.

N74-17052 Stanford Univ., Calif.
THE MIDLATITUDE IONOSPHERIC RESPONSE TO FLUCTUATIONS IN SOLAR ACTIVITY UNDER LOW GEOMAGNETIC ACTIVITY CONDITIONS Ph.D. Thesis
Jose Luis Bendito 1973 105 p
Avail: Univ. Microfilms Order No. 73-30366

The ionospheric response or the sensitivity and delay of the electron content to the 27-day fluctuations of solar radiation has been theoretically analyzed. The sensitivity is defined as the magnitude of the electron content fluctuation for a given change in solar flux, and the delay is defined as the time-shift of the response of the electron content to fluctuations in solar flux. Both the model in which the action of neutral winds on the F-2 layer is disregarded and that in which the wind effect is included as part of a positive feedback mechanism, are studied. It is shown that the neutral winds play a dominant role in the mentioned ionospheric response. The computed delays decrease with increasing solar activity in both models. Nevertheless, when the action of neutral winds is considered the delays are larger.
Dissert. Abstr.

N74-17053 Stanford Univ., Calif.
AEROMAGNETICS IN THE SEARCH FOR PORPHYRY COPPER DEPOSITS Ph.D. Thesis
Rogelio Gotardo Laraya 1973 106 p
Avail: Univ. Microfilms Order No. 73-30425

The application and limitations are clarified of aeromagnetics in porphyry copper exploration, and a critical study of aeromagnetic data, rock magnetic properties and geology in the Mina and Coaldale quadrangles, Nevada. Specifically, the paper tries to answer the question: Can porphyry copper deposits be detected on aeromagnetic maps? The approach to this problem is to characterize porphyry copper deposits and their related intrusions in terms of a typical size, shape and range of magnetization. A magnetic prism 4000 x 6000 feet in plan with a non-magnetic core is used as a model of a porphyry copper deposit in an intrusion of granitic to intermediate composition. Calculated total field anomalies for this model indicate that the outer prism, but not the magnetic low due to the non-magnetic core, is detectable at survey altitudes 1000 feet or more above the top of the prism. This result contradicts the popularly held opinion that many porphyry copper deposits are characterized by alteration low patterns that can be recognized from such altitudes.
Dissert. Abstr.

N74-17054 Stanford Univ., Calif.
INCOHERENT-SCATTER OBSERVATIONS OF AURORAL IONIZATION IN THE E-REGION Ph.D. Thesis
Murray Jerry Baron 1973 163 p
Avail: Univ. Microfilms Order No. 73-30359

Systematic incoherent-scatter measurements of auroral ionization are described. The incoherent-scatter technique is based upon the use of a high-powered radar system whose waves penetrate auroral forms and are scattered from individual electrons. Past studies of auroral ionization using other techniques have been limited by a number of factors: poor time resolution, limited temporal coverage, poor spatial resolution, and the necessity of using many assumptions and approximations regarding the applicable physics and chemistry. The incoherent-scatter technique largely overcomes these limitations and permits electron concentration measurements having good temporal and spatial resolution. The data for the study were obtained using the incoherent-scatter radar located at Chatanika, Alaska (latitude 65 degrees North). Hardware and computer software were developed that have become a basic part of the radar system and are now routinely used by all scientists conducting experiments with the radar. Dissert. Abstr.

N74-17055 Colorado State Univ., Fort Collins.
REMOTE MULTISPECTRAL SENSING OF BIOMASS Ph.D. Thesis
Robert Lawrence Pearson 1973 208 p
Avail: Univ. Microfilms Order No. 73-29057

An ecosystem analysis study is reported on an entire shortgrass prairie biome using systems analysis techniques. One of the most important spatial parameters of the grassland biome which must be determined on an areal basis is the amount of vegetation present on the prairie at a particular place and time. Small area biomass estimates have been made with a two channel spectral ratio method using a small hand-held radiometer with a biomass estimation accuracy of greater than 95%. Large area biomass determinations have been tested on multispectral scanner data using both a channel ratio technique and multispectral pattern recognition techniques. The resulting biomass maps show correlations with several ground truth sites of from 80% and 90% between the estimated biomass values from the multispectral data of an area and biomass values taken from clipped plots in the same area. Dissert. Abstr.

N74-17056 City Coll. of the City of New York.
DYNAMICS OF A PLASMA INHOMOGENEITY IN THE UPPER ATMOSPHERE, ITS DIFFUSION, OSCILLATIONS AND TURBULENT MOTIONS Ph.D. Thesis
Ralph D. Hankel 1973 166 p

Avail: Univ. Microfilms Order No. 73-28367

The motions of plasma inhomogeneities, in the sequence of the gross evolution of the plasma by diffusion, the oscillations and the development of turbulence, form the main theme of the present research. Particular emphasis is placed on providing theoretical interpretations and predictions for certain anomalous and nonlinear features, such as the splitting of the plasma inhomogeneity in the course of diffusion, the steepening of its front as a consequence of the nonlinear behavior, the appearance of striations and their governing dispersion relation, and finally the spectral structure of turbulence produced in the inhomogeneous plasma under the effects of drifts. Many of the theoretical results obtained here concerning the physical features and phenomena of the plasma inhomegeneities are confirmed by experiments. Dissert. Abstr.

N74-17057 Alaska Univ., College.
AURORAL INFRASONIC WAVES AND THE POLAR MAGNETIC SUBSTORM Ph.D. Thesis
Roland Everett Johnson 1973 288 p
Avail: Univ. Microfilms Order No. 73-23784

The relationship of auroral infrasonic waves to the polar magnetic substorm was investigated. The major emphasis is to determine whether or not there are specific regions within the Substorm where the infrasound is generated. It is found that the eastern end of the electrojet is a region which was very effective in generating infrasound, and was also a region in which supersonic auroras were observed to be propagating. The magnetic substorm is represented temporally and spatially by use of sequences of contour maps of the total horizontal disturbance vector or the total magnetic disturbance vector. It is shown that attempts to locate the source region of the auroral infrasound generator are futile in the mapping study unless there is some knowledge of the transit speed between the source and observer. A mean horizontal transit speed is derived and found to be near the value of 243 m/sec. Dissert. Abstr.

N74-17058 Maryland Univ., College Park.
A STUDY OF HIGH LATITUDE MAGNETIC DISTURBANCE Ph.D. Thesis
Robert Allan Langel 1973 218 p
Avail: Univ. Microfilms Order No. 73-28879

Variations in the total (i.e., scalar) magnetic field data from the polar orbiting OGO 2, 4, and 6 spacecraft (altitudes 400-1510 km.), with supporting vector magnetic field data from observatories at the earth's surface, are analyzed for dipole latitudes above 55 deg. Data from all degrees of magnetic disturbance are included, but emphasis is placed on periods when K sub p = 2(-) to 3(+). The principal total field variations are (1) a positive Delta B (Delta B = measured field magnitude minus the field magnitude from a mathematical model of the quiet field) region between about 22(h) and 10(h) magnetic local time (MLT) with its maximum near 3(h) and 72 deg, and (2) a negative Delta B region between about 10(h) and 22(h) MLT with its maximum near 15(h) and 75 deg. Individual satellite passes, at low altitudes, indicate the presence of a westward electrojet at about 23-6(h) MLT and an eastward electrojet at about 19-2323(h) MLT. Neither average Delta B patterns nor individual satellite passes are consistent with electrojet currents as the primary source. Dissert. Abstr.

N74-17059*# Agricultural Research Service, Weslaco, Tex.
REFLECTANCE OF VEGETATION, SOIL, AND WATER Progress Report, 19 Jun. - 19 Dec. 1973
Craig L. Wiegand, H. W. Gausman, R. W. Leamer, A. J. Richardson, and A. H. Gerbermann, Principal Investigators Feb. 1974 59 p refs ERTS
(NASA Order S-70251-AG)
(E74-10265; NASA-CR-136651) Avail: NTIS HC $5.00 CSCL 20F

The author has identified the following significant results. Iron deficient and normal grain sorghum plants were sufficiently different spectrally in ERTS-1 band 5 CCT data to detect chlorotic sorghum areas 2.8 acres (1.1 hectares) or larger in size in computer printouts of the MSS data. The ratio of band 5 to band 7 or band 7 minus band 5 relates to vegetation ground cover conditions and helps to select training samples representative of differing vegetation maturity or vigor classes and to estimate ground cover or green vegetation density in the absence of ground information. The four plant parameters; leaf area index, plant population, plant cover, and plant height explained 87 to 93% of the variability in band 6 digital counts and from 59 to 90% of the variation in bands 4 and 5. A ground area 2244 acres in size was classified on a pixel by pixel basis using simultaneously acquired aircraft support and ERTS-1 data. Overall recognition for vegetables, immature crops and mixed shrubs, and bare soil categories was 64.5% for aircraft and 59.6% for spacecraft data, respectively. Overall recognition results on a per field basis were 61.8% for aircraft and 62.8% for ERTS-1 data.

N74-17060*# California Univ., Berkeley. Space Sciences Lab.
AN INTEGRATED STUDY OF EARTH RESOURCES IN THE STATE OF CALIFORNIA BASED ON SKYLAB AND SUPPORTING AIRCRAFT DATA Quarterly Progress Report
Robert N. Colwell, James D. Nichols, Leonard W. Bowden, and Wes Chambers, Principal Investigators (Bureau of Land Management, Riverside, Calif.) 30 Nov. 1973 15 p EREP
(Contract NAS2-7562)
(E74-10266; NASA-CR-136652) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-17061*# California Univ., Berkeley. Center for Remote Sensing Research.
AGRICULTURAL INTERPRETATION TECHNIQUE DEVELOPMENT Quarterly Progress Report
Robert N. Colwell, Andrew S. Benson, Principal Investigators, Claire M. Hay, Nancy A. Jones, and Catherine E. Brown 30 Nov. 1973 15 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS2-7567)
(E74-10267; NASA-CR-136653) Avail: NTIS HC $3.00 CSCL 02D

There are no author-identified significant results in this report.

N74-17062*# Kansas State Univ., Manhattan. Evapotranspiration Lab.
FLEXIBLE DCP INTERFACE
E. T. Kanemasu, Principal Investigator and H. Schimmelpfennig [1974] 24 p ref ERTS
(Contract NAS5-21822)
(E74-10268; NASA-CR-136654; Contrib-1397; Rept-226-3) Avail: NTIS HC $3.25 CSCL 05B

The author has identified the following significant results. A user of an ERTS data collection system must supply the sensors and signal conditioning interface. The electronic interface must be compatible with the NASA-furnished data collection platform (DCP). A universal signal conditioning system for use with a wide range of environmental sensors is described. The interface is environmentally and electronically compatible with the DCP and has operated satisfactorily for a complete winter wheat growing season in Kansas.

N74-17063*# Environmental Research and Technology, Inc., Lexington, Mass.
EXPERIMENTAL EVALUATION OF ATMOSPHERIC EFFECTS ON RADIOMETRIC MEASUREMENTS USING THE EREP OF SKYLAB Quarterly Progress Report, Nov. 1973 - Jan. 1974
David T. Chang, Principal Investigator 9 Feb. 1974 8 p refs EREP
(Contract NAS9-13343)
(E74-10269; NASA-CR-136655; QPR-3) Avail: NTIS HC $3.00 CSCL 04A

There are no author-identified significant results in this report.

N74-17064*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Dec. 1973
Richard F. Nalepka and William A. Malila, Principal Investigators 24 Jan. 1974 2 p EREP

(Contract NAS9-13280)
(E74-10270; NASA-CR-136656; ERIM-101900-22-L; MPR-10) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-17065*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Jan. 1974
Irvin J. Sattinger, Principal Investigator 4 Feb. 1974 3 p EREP
(Contract NAS9-13283)
(E74-10271; NASA-CR-136657; ERIM-103300-18-L) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N74-17066*# Agricultural Research Service, Weslaco, Tex.
A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Progress Report, 1-30 Nov. 1973
William G. Hart, Sammy J. Ingle, and M. R. Davis, Principal Investigators 30 Nov. 1973 2 p EREP
(NASA Order T-4109-B)
(E74-10272; NASA-CR-136658; PR-10) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N74-17067*# Iowa Univ., Iowa City. Dept. of Geology.
EXPERIMENT TO EVALUATE FEASIBILITY OF UTILIZING SKYLAB-EREP REMOTE SENSING DATA FOR TECTONIC ANALYSIS OF THE BIGHORN MOUNTAINS REGION, WYOMING-MONTANA Quarterly Progress Report, 1 Oct. - 31 Dec. 1973
Richard A. Hoppin, Principal Investigator 8 Feb. 1974 4 p EREP
(Contract NAS9-13313)
(E74-10273; NASA-CR-136659) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. S-190A color transparencies from SL-2 of the Big Horn basin region provide the best format to date for geologic study of that region; red beds are quite mappable and resistant key beds sharply outlined. An S-190B color frame from SL-3 of the Pryor-Bighorn mountains provides no indication that the Nye-Bowler lineament extends east of East Pryor Mountain. This has important implications regarding the role of this and other lineaments (which also appear to be of restricted length) in the tectonics of the region. Extensions of these lineaments for great distances does not seem warranted on the basis of surface evidence.

N74-17068*# Texas A&M Univ., College Station. Remote Sensing Center.
MONITORING THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION Progress Report, 28 Nov. 1973 - 27 Jan. 1974
J. W. Rouse, Jr., Principal Investigator 27 Jan. 1974 10 p ERTS
(Contract NAS5-21857)
(E74-10274; NASA-CR-136660; PR-6) Avail: NTIS HC $3.00 CSCL 06F

The author has identified the following significant results. Primary emphasis during the period has been given to completing the resource and land use mask overlays for ultimate subsite MSS data extraction and analysis, refining the computer mask program, verifying resultant masks, and evaluating the initial subsite data. Standard deviations for the selected subsites were generally reduced significantly when compared to the values for the overall 7km x 7km test site areas. This indicates that the masking technique has been successful in reducing the variability of the ERTS-1 MSS data for ultimate subsite comparisons with ground data. The techniques used to locate the 7km x 7km test site areas and extract masked subsite data apparently limit the ability to reliably locate identical very small subsite areas for temporal comparisons. Current evidence indicates that areas which include less than about four pixel elements in either dimension are probably unreliable.

N74-17069*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ERTS-A IMAGERY INTERPRETATION TECHNIQUES IN THE TENNESSEE VALLEY Progress Report, 25 Nov. 1973 - 25 Jan. 1974
Robert E. Bodenheimer, Principal Investigator 5 Feb. 1974 2 p ERTS
(Contract NAS5-21875)
(E74-10275; NASA-CR-136661) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N74-17070*# Wolf Research and Development Corp., Riverdale, Md.
THE INTERDEPENDENCE OF LAKE ICE AND CLIMATE IN CENTRAL NORTH AMERICA Progress Report, Dec. 1973 - Jan. 1974
Allan J. Jelacic, Principal Investigator 10 Feb. 1974 6 p refs ERTS
(Contract NAS5-21761)
(E74-10276; NASA-CR-136662; PR-7) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N74-17071*# Geological Survey, Reston, Va.
DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO Progress Report, 1 Jul. - 31 Dec. 1973
Edward J. Pluhowski, Principal Investigator 1 Jan. 1974 7 p ERTS
(NASA Order S-70243-AG-2)
(E74-10278; NASA-CR-136664) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Two unusual turbidity features were detected in imagery obtained over Lake Ontario on September 19, 1973. The location of a submerged sewer outfall was detected in frame 1423-15224-5 about 2 kilometers offshore opposite a treatment plant serving Rochester, New York. The other feature was a thermal heat plume made visible by an erosive eastward moving longshore current. The thermal plume, which extended about 3 kilometers into the lake, results from the discharge of cooling water from a nuclear power plant located 20 miles east of Rochester, New York. Under an offshore wind field, the outer edge of the Niagara River plume extended 30 kilometers into Lake Ontario on September 3, 1973. By way of contrast, a strong west-northwest wind on April 29, 1973, confined the plume to about 3 kilometers of the lake's south shore. The size of the Genesee River plume is largely dependent on discharge. During the spring high flow season, the plume extended over 22 square kilometers of the lake's surface on May 16, 1973. As runoff dwindled with the approach of summer, the plume contracted to less than 1 square kilometer in area by mid-July.

N74-17072*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENT BOUNDARY LAYER Monthly Progress Report, Jan. 1974
George A. Maul, Principal Investigator Jan. 1974 3 p EREP
(NASA Order T-4713-B)
(E74-10280; NASA-CR-136666; MPR-7) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N74-17073*# Nevada Univ., Reno. Mackay School of Mines.
THE GREAT BASIN INVESTIGATION Monthly Progress Report, Jan. 1974
Jack G. Quade, Principal Investigator Jan. 1974 3 p EREP
(Contract NAS9-13274)
(E74-10281; NASA-CR-136667) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N74-17074*# Cornell Univ., Ithaca, N.Y. Div. of Atmospheric Sciences.
PHENOLOGY SATELLITE EXPERIMENT Progress Report, Feb. - Aug. 1973
Bernard E. Dethier, M. Ashley (Maine Univ.), B. Blair (Purdue Univ.), J. Caprio (Montana State Univ.), R. Hopp (Vermont Univ.), and J. Rouse, Jr., Principal Investigators (Texas A and M Univ.) 15 Oct. 1973 73 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21781)
(E74-10282; NASA-CR-136668) Avail: NTIS HC $5.75 CSCL 02F

The author has identified the following significant results. The 1972 Brown Wave and 1973 Green Wave were detected at 24 sites located in four north-south corridors across the United States through analysis of ERTS-1 imagery and multispectral scanner digital tapes. Ground observations from these sites were correlated with ERTS data. These two phenological events were documented by observations from more than 3200 sites across the United States. The problem of changing atmospheric and illumination conditions were studied and corrections to ERTS data suggested. Band-to-band ratios were developed and correlated with the fall and spring phenological changes in field crops and forests. The results to date show the feasibility of developing and refining phenoclimatic models for use in characterizing crop status and as an aid to yield prediction.

N74-17075*# Rockwell International Science Center, Thousand Oaks, Calif.
TECTONIC ANALYSIS OF BAJA CALIFORNIA AND PARRAS SHEAR BELT IN MEXICO Progress Report, Jun. - Nov. 1973
Monem Abdel-Gawad, Principal Investigator and Linda Tubbesing Jan. 1974 30 p refs ERTS
(Contract NAS5-21767)
(E74-10283; NASA-CR-136669; SC543.9PR) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. Geological correlation of terrain across the Gulf of California using ERTS-1 imagery revealed significant similarities between Isla Tiburon, Isla Angel de la Guarda, and the San Carlos Range in mainland Mexico. ERTS-1 imagery was used to check the validity of the existence of major trans-Baja fault zones. ERTS-1 imagery also shows that high albedo sediments similar to known late Tertiary marine sediments are widespread in southern and middle Baja and extend in places to the eastern side of the Peninsula. Major faults in northern Mexico and across the border in the United States were mapped, and ample evidence was found that the Parras and parts of the Texas lineament are belts of major transverse shear faults in areas outside the supposed limit of the Texas and Parras lineaments. A fundamental concept which may help explain many complexities in the tectonic development is beginning to emerge: The southwestern part of North America was torn by massive left-lateral shear of transverse trend (east-west) during the compressive stage of the late Mesozoic and early Cenozoic. This tectonic style has changed into tensional rifting (Basin and Range) and right-lateral shear later in the Cenozoic and Quaternary.

N74-17076*# Rockwell International Science Center, Thousand Oaks, Calif.
IDENTIFICATION AND INTERPRETATION OF TECTONIC FEATURES FROM ERTS-A IMAGERY Progress Report, 1 Dec. 1973 - 31 Jan. 1974
Monem Abdel-Gawad, Principal Investigator 6 Feb. 1974 3 p ERTS
(Contract NAS5-21767)
(E74-10284; NASA-CR-136670; SC543.10PR) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. A set of criteria characterizing known mineralized areas are: (1) occurrence at structural bends, discontinuities, complex deformations along fault zones and intersections; (2) complex terrain textures produced by fracture intersections; (3) color and tone anomalies produced by igneous intrusives, alteration effects, and oxidation. Significant fracture systems which appear to be most commonly related to mineralization in central and northeastern Nevada trend northeast-southwest, north-south, and north-northwest. In the area from Goldfield and Beatty, Nevada, to south of Las Vegas, ERTS-1 and Skylab imagery have been examined together to study an apparent correlation of mineralized areas with suspected hydrothermal alteration effects. It was observed that areas of mineralization are of complex structure, usually cut by many fractures, and sometimes have a similar mottled or variegated appearance. Although the Beatty-Rhyolite mining district is now largely inactive, several analogous areas not known to be mineralized have been identified. Identification of specific mineral prospects within general targets requires extensive field work and detailed geophysical exploration.

N74-17077*# Corps of Engineers, Waltham, Mass.
NEW ENGLAND RESERVOIR MANAGEMENT Progress Report, 3-23 Jan. 1974
Saul Cooper and Duwayne Anderson, Principal Investigators (CRREL) 23 Jan. 1974 3 p EREP
(NASA Order T-4646-B)
(E74-10286; NASA-CR-136672) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N74-17078*# Cornell Univ., Ithaca, N.Y.
PHENOLOGY SATELLITE EXPERIMENT Progress Report, 8 Aug. - 8 Oct. 1973
Bernard E. Dethier, Principal Investigator 8 Oct. 1973 3 p ERTS
(Contract NAS5-21781)
(E74-10288; NASA-CR-136674) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N74-17079*# Cornell Univ., Ithaca, N.Y.
PHENOLOGY SATELLITE EXPERIMENT Progress Report, 8 Oct. - 8 Dec. 1973
Bernard E. Dethier, Principal Investigator 8 Dec. 1973 2 p refs ERTS
(Contract NAS5-21781)
(E74-10289; NASA-CR-136675) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N74-17080*# Alaska Univ., Fairbanks.
APPLICATION OF ERTS-1 IMAGERY TO THE STUDY OF CARIBOU MOVEMENTS AND WINTER DISPERSAL IN RELATION TO PREVAILING SNOWCOVER Bimonthly Progress Report
Peter C. Lent, Principal Investigator 31 Jan. 1974 5 p refs ERTS
(Contract NAS5-21833)
(E74-10291; NASA-CR-136678; BMPR-9) Avail: NTIS HC $3.00 CSCL 06C

The author has identified the following significant results. A multiband classification scheme was applied to ERTS-1 MSS digital tape data in a portion of the Yukon Flats area. Primary analytic objectives of mapping the extent of recent wildfire burns and mature forest were realized illustrating application to moose and caribou biology. Additionally, the analysis indicated the presence of new lakes as well as disappearance of lakes present in 1956. Because this is an important waterfowl production area, similar analyses may have significant application potential to waterfowl biology for rapid updating of habitat information. Further field confirmation of this finding is required.

N74-17081*# Alaska Univ., Fairbanks. Geophysical Inst.
FEASIBILITY STUDY FOR LOCATING ARCHAEOLOGICAL VILLAGE SITES BY SATELLITE REMOTE SENSING TECHNIQUES Progress Report, Jan. - Jul. 1973
John P. Cook, Principal Investigator and W. J. Stringer 30 Jan. 1974 16 p ref ERTS
(Contract NAS5-21833)

(E74-10292; NASA-CR-136679) Avail: NTIS HC $4.00 CSCL 08F

The author has identified the following significant results. The objective is to determine the feasibility of detecting large Alaskan archaeological sites by satellite remote sensing techniques and mapping such sites. The approach used is to develop digital multispectral signatures of dominant surface features including vegetation, exposed soils and rock, hydrological patterns and known archaeological sites. ERTS-1 scenes are then printed out digitally in a map-like array with a letter reflecting the most appropriate classification representing each pixel. Preliminary signatures were developed and tested. It was determined that there was a need to tighten up the archaeological site signature by developing accurate signatures for all naturally-occurring vegetation and surface conditions in the vicinity of the test area. These second generation signatures have been tested by means of computer printouts and classified tape displays on the University of Alaska CDU-200 and by comparison with aerial photography. It has been concluded that the archaeological signatures now in use are as good as can be developed. Plans are to print out signatures for the entire test area and locate on topographic maps the likely locations of archaeological sites within the test area.

N74-17082*# Alaska Univ., Fairbanks. Inst. of Marine Science.
THE CIRCULATION OF PRINCE WILLIAM SOUND Bi-monthly Progress Report
Robin D. Muench, Principal Investigator 31 Jan. 1974 2 p ERTS
(Contract NAS5-21833)
(E74-10293; NASA-CR-136680; BMPR-9) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N74-17083*# Alaska Univ., Fairbanks.
FEASIBILITY STUDY FOR LOCATING ARCHAEOLOGICAL VILLAGE SITES BY SATELLITE REMOTE SENSING TECHNIQUES Bimonthly Progress Report, Aug. - Sep. 1973
John P. Cook, Principal Investigator Sep. 1973 6 p ref ERTS
(Contract NAS5-21833)
(E74-10294; NASA-CR-136681; BMPR-7) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-17084*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-31 Jan. 1974
A. G. Mourad and D. M. J. Fubara, Principal Investigators 18 Feb. 1974 7 p EREP
(Contract NAS9-13276)
(E74-10295; NASA-CR-136682; PR-11) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N74-17085*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND RESOURCES, INCLUDING FOREST STRESS Monthly Progress Report, 16 Dec. 1973 - 15 Jan. 1974
Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 20 Jan. 1974 7 p EREP
(NASA Order T-4106-B)
(E74-10296; NASA-CR-136683; MPR-9) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. Some current beetle-killed ponderosa pine can be detected on S190-B photography imaged over the Bear Lodge mountains in the Black Hills National Forest. Detections were made on SL-3 imagery (September 13, 1973) using a zoom lens microscope to view the photography. At this time correlations have not been made to all of the known infestation spots in the Bear Lodge mountains; rather, known infestations have been located on the SL-3 imagery. It was determined that the beetle-killed trees were current kills by stereo viewing of SL-3 imagery on one side and SL-2 on the other. A successful technique was developed for mapping current beetle-killed pine using MSS imagery from mission 247 flown by the C-130 over the Black Hills test site in September 1973. Color enhancement processing on the NASA/JSC, DAS system using three MSS channels produced an excellent quality detection map for current kill pine. More importantly it provides a way to inventory the dead trees by relating PCM counts to actual numbers of dead trees.

N74-17086*# Geological Survey, Reston, Va.
THE UTILIZATION OF ERTS-1-GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Nov. - 31 Dec. 1973
Daniel B. Krinsley, Principal Investigator 15 Jan. 1974 2 p ERTS
(NASA Order S-70243-AG-3)
(E74-10297; NASA-CR-136340) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. False-color composites made from ratioed and stretched transparencies, generated from CCT's of ERTS-1, have enhanced hydrologic and morphologic differences within the playa surficial sediments. A composite of ratios 4/6, 5/7,15/61 and 4/7 using blue, red, yellow, and green, respectively, was useful in separating wet, water, and dry areas in the salt crust and for delineating smooth and rough salt where relief was less than 20 cm.

N74-17087*# Geological Survey, Reston, Va.
THE UTILIZATION OF ERTS-1-GENERATED PHOTOGRAPHS IN THE EVALUATION OF THE IRANIAN PLAYAS AS POTENTIAL LOCATIONS FOR ECONOMIC AND ENGINEERING DEVELOPMENT Progress Report, 1 Sep. - 31 Oct. 1973
Daniel B. Krinsley, Principal Investigator 31 Oct. 1973 2 p ERTS
(NASA Order S-70243-AG-3)
(E74-10298; NASA-CR-136692) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Hydrologic inventories, throughout the year, were made in interior basins that have not been measured previously because of their inaccessibility. Interior basins during the last ERTS-1 year (August 1972 to August 1973) had driest ground conditions in late September 1972 and had wettest ground conditions from March through May 1973, depending upon location. Bearing strengths of playa soils can be inferred from the changing hydrologic conditions through the seasons as recorded by ERTS-1, with prior ground control. Slight differences in salt-crust morphology and in moisture contest of playa soils can be greatly enhanced by rationing and stretching techniques. Differences in water area and silt content can be enhanced by using a three-stage photographic masking technique employing bands 4, 5, and 7.

N74-17088*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGES, SOUTHERN CALIFORNIA Monthly Progress Report, Feb. 1974
Paul M. Merifield, Principal Investigator 5 Feb. 1974 3 p EREP
(Contract NAS2-7698)
(E74-10299; NASA-CR-136693; MPR-8) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N74-17089*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
[OBTAIN DATA OVER FOUR BASIC TEST AREAS WITHIN THE WABASH VALLEY RIVER BASIN WITH EMPHASIS ON CROP IDENTIFICATION, ACREAGE MENSURATION AND URBAN STUDIES] Monthly Report, May 1973
LeRoy F. Silva, Principal Investigator May 1973 2 p EREP
(Contract NAS9-13301)

(E74-10300; NASA-CR-136770) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N74-17090*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

USE OF ERTS-1 DATA: SUMMARY REPORT OF WORK ON TEN TASKS Progress Report, 1 Jul. - 31 Dec. 1973

Frederick J. Thomson, F. C. Polcyn, M. Leonard Bryan, I. J. Sattinger, W. A. Malila, R. F. Nalepka, C. T. Wezernak, R. Horvath, and R. K. Vincent, Principal Investigators 25 Jan. 1974 80 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21783)

(E74-10301; NASA-CR-136771; ERIM-193300-37-P) Avail: NTIS HC $6.00 CSCL 05B

The author has identified the following significant results. Depth mapping's for a portion of Lake Michigan and at the Little Bahama Bank test site have been verified by use of navigation charts and on-site visits. A thirteen category recognition map of Yellowstone Park has been prepared. Model calculation of atmospheric effects for various altitudes have been prepared. Radar, SLAR, and ERTS-1 data for flooded areas of Monroe County, Michigan are being studied. Water bodies can be reliably recognized and mapped using maximum likelihood processing of ERTS-1 digital data. Wetland mapping has been accomplished by slicing of single band and/or ratio processing of two bands for a single observation date. Both analog and digital processing have been used to map the Lake Ontario basin using ERTS-1 data. Operating characteristic curves were developed for the proportion estimation algorithm to determine its performance in the measurement of surface water area. The signal in band MSS-5 was related to sediment content of waters by modelling approach and by relating surface measurements of water to processed ERTS data. Radiance anomalies in ERTS-1 data could be associated with the presence of oil on water in San Francisco Bay, but the anomalies were of the same order as those caused by variations in sediment concentration and tidal flushing.

N74-17091*# Cornell Univ., Ithaca, N.Y. New York State College of Agriculture and Life Sciences.

EVALUATION OF SKYLAB IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES Progress Report, 1-31 Jan. 1974

Ernest E. Hardy, Principal Investigator and Deborah Stevens 31 Jan. 1974 11 p EREP

(Contract NAS9-13364)

(E74-10302; NASA-CR-136784) Avail: NTIS HC $4.00 CSCL 05B

There are no author-identified significant results in this report.

N74-17092*# Wolf Research and Development Corp., Riverdale, Md.

THE INTERDEPENDENCE OF LAKE ICE AND CLIMATE IN CENTRAL NORTH AMERICA Progress Report, Jun. - Jul. 1973

A. J. Jelacic, Principal Investigator 10 Aug. 1973 10 p ERTS

(Contract NAS5-21761)

(E74-10303; NASA-CR-136785; PR-5) Avail: NTIS HC $4.00 CSCL 08L

There are no author-identified significant results in this report.

N74-17093*# Army Engineer Waterways Experiment Station, Vicksburg, Miss. 08H

MAPPING SUSPENDED PARTICLE AND SOLUTE CONCENTRATIONS FROM SATELLITE DATA

Warren E. Grabau, Principal Investigator and A. N. Williamson 4 Feb. 1974 33 p Presented at the ASCE Natl. Water Resources Eng. Meeting, Los Angeles, 21-25 Jan. 1974 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70259-AG)

(E74-10304; NASA-CR-136786) Avail: NTIS HC $4.75

There are no author-identified significant results in this report.

N74-17094*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

INVENTORY OF FOREST AND RANGELAND AND DETECTION OF FOREST STRESS Progress Report, 1 Jul. - 31 Dec. 1973

Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 20 Jan. 1974 28 p ref Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70251-AG)

(E74-10306; NASA-CR-136788; FS-II-3; PR-3) Avail: NTIS HC $4.50 CSCL 02F

The author has identified the following significant results. Disturbances in a forest environment that cause reductions in forest area, timber volume, and timber growth can be detected on ERTS-1 combined color composites. However, detection depends on comparing a conventional aerial photograph taken at some base year with an ERTS-1 image taken in some subsequent year. In a test made on the Atlanta site, 1:63,360 scale aerial photo index sheets made in 1966 were compared with ERTS-1 image 1264-15445 (April 1973). Five factors were found important to detection reliability: (1) the quality of the imagery; (2) the season of the imagery; (3) the size of the disturbed area; (4) the number of years since the disturbances; and (5) the type of cutting treatment. Of 209 disturbances verified on aerial photography, 165 (or approximately 80%) were detected on the ERTS-1 image by one independent interpreter. Improved training and additional experience in using this low resolution imagery should improve detection. Of the two seasons of data studies (fall and early spring), early spring is the best for detecting land use changes. Generally speaking, winter, early spring, and early summer are the best times of year for detecting forest disturbances.

N74-17095*# Boeing Co., Kent, Wash.

[MICRODENSITOMETER SCANNING OF SL3 S190 IMAGERY AND ACCOMPANYING STEP WEDGES] Monthly Report, Jan. 1974

David L. Tingey, Principal Investigator Jan. 1974 2 p EREP

(Contract NAS9-13303)

(E74-10307; NASA-CR-136789) Avail: NTIS HC $4.00 CSCL 14B

There are no author-identified significant results in this report.

N74-17096*# Colorado School of Mines, Golden. Dept. of Geology.

GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Monthly Progress Report, Jan. 1974

Keenan Lee, Principal Investigator 15 Feb. 1974 7 p EREP

(Contract NAS9-13394)

(E74-10308; NASA-CR-136790) Avail: NTIS HC $4.00 CSCL 08G

There are no author-identified significant results in this report.

N74-17097*# South Dakota State Univ., Brookings. Remote Sensing Inst.

[DEVELOP TECHNIQUES AND PROCEDURES, USING MULTISPECTRAL SYSTEMS, TO IDENTIFY FROM REMOTELY SENSED DATA THE PHYSICAL AND THERMAL CHARACTERISTICS OF PLANTS AND SOIL] Monthly Report, period ending 1 Jan. 1974

Victor I. Myers, Principal Investigator 1 Jan. 1974 2 p EREP

(Contract NAS9-13337)

(E74-10310; NASA-CR-136792) Avail: NTIS HC $4.00 CSCL 08M

There are no author-identified significant results in this report.

N74-17098*# Michigan State Univ., East Lansing.

INVESTIGATION OF SKYLAB DATA Monthly Plans and Progress Report, Jan. 1974

Lester V. Manderscheid, Principal Investigator Jan. 1974 3 p EREP
(Contract NAS9-13332)
(E74-10311; NASA-CR-136796) Avail: NTIS HC $4.00 CSCL 05B

There are no author-identified significant results in this report.

N74-17099*# Wyoming Univ., Laramie. Dept. of Geology.
IDENTIFICATION OF IRRIGATED CROP TYPES FROM ERTS-1 DENSITY CONTOUR MAPS AND COLOR INFRARED AERIAL PHOTOGRAPHY Special Report
Ronald W. Marrs and Michael A. Evans 15 Jan. 1974 16 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21799)
(E74-10312; NASA-CR-136797; ERTS-1-S74-1) Avail: NTIS HC $4.00 CSCL 02C

The author has identified the following significant results. The crop types of a Great Plains study area were mapped from color infrared aerial photography. Each field was positively identified from field checks in the area. Enlarged (50x) density contour maps were constructed from three ERTS-1 images taken in the summer of 1973. The map interpreted from the aerial photography was compared to the density contour maps and the accuracy of the ERTS-1 density contour map interpretations were determined. Changes in the vegetation during the growing season and harvest periods were detectable on the ERTS-1 imagery. Density contouring aids in the detection of such charges.

N74-17100*# Agricultural Research Service, Weslaco, Tex.
IRRIGATION SCHEDULING, FREEZE WARNING AND SOIL SALINITY DETECTING Monthly Progress Reports, Nov. 1973 - Jan. 1974
Craig L. Wiegand, Principal Investigator 15 Feb. 1974 4 p EREP
(NASA Order T-4105-B)
(E74-10313; NASA-CR-136798; MPR-5) Avail: NTIS HC $4.00 CSCL 02C

There are no author-identified significant results in this report.

N74-17101*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
GEOLOGIC ANALYSIS AND EVALUATION OF ERTS-A IMAGERY FOR THE STATE OF NEW MEXICO Progress Report, 29 Nov. 1973 - 29 Jan. 1974
Frank E. Kottlowski, Principal Investigator 29 Jan. 1974 5 p ERTS
(Contract NAS5-21861)
(E74-10314; NASA-CR-136799) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. Many circular to elliptical features have been identified on the ERTS-1 images, only some of which can be accounted for by existing data. A small number of circular features are adjacent to existing ore deposits, but such relationships should not be emphasized unless other supporting data exists. Circular features may be tectonically or geomorphically controlled, or a combination of the two. A limited number are man-made. A preliminary listing of features which may have circular expression are listed. Photographic examples of identified and unidentified circular features will be included in the final report along with a thorough discussion and analysis. Comparisons will be made with existing gravity and magnetic data.

N74-17102*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AN INTERDISCIPLINARY ANALYSIS OF MULTISPECTRAL SATELLITE DATA FOR SELECTED COVER TYPES IN THE COLORADO MOUNTAINS, USING AUTOMATIC DATA PROCESSING TECHNIQUES Monthly Progress Report, Jan. 1974
Roger M. Hoffer, Principal Investigator Jan. 1974 7 p EREP (Contract NAS9-13380)
(E74-10316; NASA-CR-136805) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N74-17103*# Natural Resources Management Corp., Berkeley, Calif. Research and Development Div.
INVESTIGATION OF THE DETECTION AND MONITORING OF FOREST INSECT INFESTATIONS IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA Progress Report, 1 Jun. - 30 Sep. 1973
Ralph C. Hall, Principal Investigator 30 Nov. 1973 7 p ERTS
(Contract NAS5-21770)
(E74-10318; NASA-CR-136807) Avail: NTIS HC $4.00 CSCL 06C

The author has identified the following significant results. In earlier reports it has been indicated that it is possible to delineate areas of lodgepole pine timber mortality into three degrees of damage from enlarged ERTS-1 color composites; light, medium, and heavy. It can also be confidently reported that it is now possible to detect all major areas of lodgepole pine defoliated by the needle miner. It has also been confirmed, through ground checking and helicopter observation that previous designation of the following features have been consistently accurate: timbered vs non-timbered areas; timber types; damaged vs undamaged areas; lakes, dome shadows which resemble lakes, mountain meadows, pasture and agricultural land, desert; riparian vegetation; and glaciers.

N74-17104*# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENTS Bimonthly Report, 4 Nov. 1973 - 4 Jan. 1974
George A. Maul, Principal Investigator 4 Jan. 1974 32 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70246-AG)
(E74-10319; NASA-CR-136808) Avail: NTIS HC $4.75 CSCL 08C

The author has identified the following significant results. A time series of the Loop Current in the Gulf of Mexico, covering an annual cycle of growth, spreading, and decay, has been obtained in synchronization with ERTS-1. Computer enhanced images, which are necessary to extract useful oceanic information, show that the current can be observed either by color or sea state effects associated with the cyclonic boundary. The color effect relates to the spectral variations in the optical properties of the water and its suspended particles, and is studied by radiative transfer theory. Significant oceanic parameters identified are: the probability of forward scattering, and the ratio of scattering to total attenuation. Several spectra of upwelling diffuse light are computed as a function of the concentration of particles and yellow substance. These calculations compare favorably with experimental measurements and show that the ratio of channels method gives ambiguous interpretative results. These results are used to discuss features in images where surface measurements were obtained and are extended to tentative explanation in others.

N74-17105*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
A STUDY OF THE UTILIZATION OF ERTS-1 DATA FROM THE WABASH RIVER BASIN Progress Report, 1 Jul. - 31 Dec. 1973
David A. Landgrebe, Principal Investigator et al Jan. 1974 52 p ERTS
(Contract NAS5-21773)
(E74-10321; NASA-CR-136812) Avail: NTIS HC $5.75 CSCL 08H

The author has identified the following significant results. The most significant results were obtained in the water resources research, urban land use mapping, and soil association mapping projects. ERTS-1 data was used to classify water bodies to determine acreages and high agreement was obtained with USGS figures. Quantitative evaluation was achieved of urban land use classifications from ERTS-1 data and an overall test accuracy of 90.3% was observed. ERTS-1 data classifications of soil test sites were compared with soil association maps scaled to match

the computer produced map and good agreement was observed. In some cases the ERTS-1 results proved to be more accurate than the soil association map.

N74-17106*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Plans and Progress Report, 1-31 Jan. 1974
Charles E. Poulton, Principal Investigator 31 Jan. 1974 31 p EREP
(Contract NAS9-13286)
(E74-10323; NASA-CR-136814) Avail: NTIS HC $4.75 CSCL 08B

There are no author-identified significant results in this report.

N74-17107*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Quarterly Progress Report, 1 Nov. 1973 - 31 Jan. 1974
John W. Hannah, Garland L. Thomas, and Fernando Esparza, Principal Investigators 1 Feb. 1974 13 p Prepared in cooperation with Brevard County Planning Dept., Titusville, Fla. Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order CC-30281-A)
(E74-10324; NASA-TM-X-69862) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N74-17108*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
THE COMPUTATION OF 15 DEG AND 10 DEG EQUAL AREA BLOCK TERRESTRIAL FREE AIR GRAVITY ANOMALIES
D. P. Hajela Feb. 1973 27 p refs
(Grant NGR-36-008-161; OSURF Proj. 3210)
(NASA-CR-132929; Rept-194) Avail: NTIS HC $4.50 CSCL 08N

Starting with the set of 23,355 1 deg x 1 deg mean free air gravity anomalies used in Rapp (1972) to form a 5 deg equal area block terrestrial gravity field, the computation of 15 deg equal area block mean free air gravity anomalies is described along with estimates of their standard deviations. A new scheme of an integral division of a 15 deg block into 9 component 300 n. m. blocks, and each 300 n. m. block being subdivided into 25 60 n.mi. blocks, is used. This insures that there is no loss in accuracy, which would have resulted if proportional values according to area were taken of the 5 deg equal area anomalies to form the 15 deg block anomalies. A similar scheme is used for the computation of 10 deg equal area block mean free air gravity anomalies with estimates of their standard deviations. The scheme is general enough to be used for a 30 deg equal area block terrestrial gravity field. Author

N74-17109*# GCA Corp., Bedford, Mass. Technology Div.
INVESTIGATION OF THE D AND E REGIONS OF THE IONOSPHERE Final Report
R. N. Kelly, A. Engelman, and A. F. Tobey Nov. 1973 116 p refs
(Contract NASw-1994)
(NASA-CR-136941; GCA-TR-73-6-N) Avail: NTIS HC $9.00 CSCL 04A

Details of an experimental program that investigates the ionosphere using sounding rockets are presented. The investigation is part of a continuing program to gather data on the D and E regions of the ionosphere during periods of recurring natural phenomena that influence these regions. To achieve these ends, four vehicles were launched during the eclipse of the sun on March 7, 1970. Other vehicles totalling 10 in all were launched to investigate transient phenomena such as the sporadic E layer. Author

N74-17110*# National Aeronautics and Space Administration, Washington, D.C.
THEORY OF OSCILLATION OF THE EARTH'S ATMOSPHERE
L. A. Dikiy Feb. 1974 296 p refs Transl. into ENGLISH of the publ. "Teoriya Kolebaniy Zemnoy Atomosfery" Leningrad, Hydrometeorol. Press, 1969 p 1-195 Sponsored in part by NSF
(NASA-TT-F-15404; TT-71-53152) Avail: NTIS HC $17.00 CSCL 04A

The theory of oscillations of the earth's atmosphere is discussed. Topics include: equations of the theory of disturbances; Laplace equation of the theory of tides; characteristic asymptotic courves of Laplace equation for low equivalent depths; verticle structure of oscillation; energy of oscillations; propagation of disturbances from instantaneous point sources; and the wind factor in atmospheric free oscillation frequencies. A set of equations of atmospheric movements is developed. K.M.M.

N74-17111# Bureau of Mines, Pittsburgh, Pa. Pittsburgh Mining and Safety Research Center.
GEOLOGIC STRUCTURE ANALYSIS USING RADAR IMAGERY OF THE COAL MINING AREA OF BUCHANAN COUNTY, VA.
C. H. Elder, P. W. Jeran, and D. A. Keck 1974 33 p refs
(BM-RI-7869) Avail: NTIS HC $4.75

An analysis of the geologic structure of an area of Buchanan County, Va., was made using imagery from an airborne AN/APQ-97 side-looking radar system to evaluate a mapping technique for delineating structural features that may cause mining problems. Side-looking airborne radar (SLAR) was found to be a useful remote sensing tool for geologic structural analysis. Fault and joint systems identified by lineaments and linear patterns in the imagery were verified by surface and in-mine observations. Little Paw Paw fault was extended 10 miles by SLAR lineament analysis. A 22-mile fault, here named the Bishop-Bradshaw Creek fault, was mapped by lineament analysis and verified by observation of the fault on the Bishop Coal Co. mine map and on offset patterns of commercial gas production along the fault and surface observation of lineament along the fault. Three major super-imposed joint sets and several fault or fractured zones were identified by SLAR lineament analysis, showing more complex structure than earlier mapping indicated. The SLAR imagery accurately delineated structural features that are known to affect gas migration and accumulation and that weaken the rock forming the immediate roof to mine workings, causing mining problems and potentially hazardous environment in the mines. Author

N74-17112*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
MEAN MERIDIONAL CIRCULATION IN THE SOUTHERN HEMISPHERE STRATOSPHERE DURING THE POLAR NIGHT
Robert F. Adler Nov. 1973 29 p refs
(Grant NGR-06-002-098)
(NASA-CR-136828; CSU-ATS-209; US-ISSN-0067-0340) Avail: NTIS HC $4.50 CSCL 04A

Atmospheric structure derived from satellite, multichannel radiance data is used to calculate zonally averaged vertical motions in the wintertime stratosphere of both hemispheres. The Northern Hemisphere calculations confirm the two celled meridional circulation calculated by previous authors. The Southern Hemisphere results show a three celled structure with descending motion over the South Pole. The variability of the mean meridional circulation in the Southern Hemisphere in relation to the presence or absence of a minor midwinter warming is also discussed. Author

N74-17113*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
PROPERTIES OF WATER VAPOR RELEVANT TO ITS MEASUREMENT IN THE STRATOSPHERE AND MESOSPHERE
Richard L. Longbothum 23 Jan. 1974 123 p refs
(Grants NGL-39-009-003; NSF GA-33446X)
(NASA-CR-136736; PSU-IRL-SCI-420) Avail: NTIS HC $9.25 CSCL 04A

The literature on the concentrations of water vapor in the stratosphere and mesosphere was studied. It is estimated that

the concentrations in these lie in the range from 0.1 ppm to 10 ppm. A survey was made of the scattering and radiative transfer properties of water vapor and the background constituents to determine the physical properties of importance to measurements of concentrations. It was determined that absorption and emission properties provide significant increases in sensitivity compared with the various scattering phenomena considered. Microwave absorption in the region of 22 GHz and 183 GHz and infrared absorption in the vibrational rotational band systems seem to be the most attractive techniques. Various experimental configurations are analyzed and compared. Author

N74-17114*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
THERMAL AND SUPRATHERMAL PLASMA DENSITIES IN THE OUTER MAGNETOSPHERE
D. A. Gurnett and L. A. Frank Oct. 1973 30 p refs
(Contracts NAS5-11074; NAS5-11039; Grant NGL-16-001-043; Contract N00014-68-A-0196-0009)
(NASA-CR-136735; U-of-Iowa-73-37) Avail: NTIS HC $4.50 CSCL 04A

Using the low-frequency cutoff of electromagnetic noise trapped in the magnetosphere at frequencies above the local plasma frequency, it is now possible to make very accurate, + or - 1%, electron density measurements in the low density region between the magnetopause and plasmapause. This technique for measuring the total plasma density was used, together with measurements of the suprathermal proton intensities with the LEPEDEA instrumentation on the IMP-6 spacecraft, to determine the thermal proton densities in the region between the plasmapause and magnetopause. Although the thermal protons usually account for a significant fraction, approximately 50%, of the total proton density in this region, in some cases, particularly at the larger radial distances the density of the thermal protons sometimes drops to a very small fraction, < 5%, of the total density and nearly all of the plasma consists of suprathermal particles. Author

N74-17115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN COLOR SPECTRUM CALCULATIONS
W. R. McCluney Feb. 1974 39 p refs Submitted for publication
(NASA-TM-X-70594; X-913-74-53) Avail: NTIS HC $5.00 CSCL 08J

The development is considered of procedures for measuring a number of subsurface oceanographic parameters using remotely sensed ocean color data. It is proposed that the first step in this effort should be the development of adequate theoretical models relating the desired oceanographic parameters to the upwelling radiances to be observed. A portion of a contributory theoretical model is shown to be described by a modified single scattering approach based upon a simple treatment of multiple scattering. The resulting quasi-single scattering model can be used to predict the upwelling distribution of spectral radiance emerging from the sea. The shape of the radiance spectrum predicted by this model for clear ocean water shows encouraging agreement with measurements made at the edge of the Sargasso Sea off Cape Hatteras. Author

N74-17116*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ION COMPOSITION AND DRIFT OBSERVATIONS IN THE NIGHTTIME EQUATORIAL IONOSPHERE
R. A. Goldberg, A. C. Aikin, and B. V. Krishna Murthy (Space Sci. and Technol. Center) Feb. 1974 23 p refs Submitted for publication
(NASA-TM-X-70593; X-625-74-50) Avail: NTIS HC $4.25 CSCL 04A

The first in situ measurements of ion composition in the nighttime equatorial E and F region ionospheres (90-300 km) are presented and discussed. These profiles were obtained by two rocket-borne ion mass spectrometers launched from Thumba, India on March 9-10, 1970 at solar zenith angles of 112 deg and 165 deg. Ionosonde data established that the composition was measured at times bounding a period of F region downward drift. During this period the ions O(+) and N(+) were enhanced by one to three orders of magnitude between 220 and 300 km. Below the drift region (200 km), O(+) ceased to be the major ionic constituent, but the concentrations of O(+) and N(+) remained larger than predicted from known radiation sources and loss processes. Here also, both the O2(+) and NO(+) profiles retained nearly the same shape and magnitude throughout the night in agreement with theories assuming scattered UV radiation to be the maintaining source. Light metallic ions including Mg(+), Na(+) and possibly Si(+) were observed to altitude approaching 300 km, while the heavier ions Ca(+) and K(+) were seen in reduced quantity to 200 km. All metal ion profiles exhibited changes which can be ascribed to vertical drifting. Author

N74-17117*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ERROR ENHANCEMENT IN GEOMAGNETIC MODELS DERIVED FROM SCALAR DATA
David P. Stern and Joseph H. Bredekamp Feb. 1974 25 p refs Submitted for publication
(NASA-TM-X-70592; X-602-74-45) Avail: NTIS HC $4.25 CSCL 20J

Models of the main geomagnetic field are generally represented by a scalar potential gamma expanded in a finite number of spherical harmonics. Very accurate observations of F were used, but indications exist that the accuracy of models derived from them is considerably lower. One problem is that F does not always characterize gamma uniquely. It is not clear whether such ambiguity can be encountered in deriving gamma from F in geomagnetic surveys, but there exists a connection, due to the fact that the counterexamples of Backus are related to the dipole field, while the geomagnetic field is dominated by its dipole component. If the models are recovered with a finite error (i.e. they cannot completely fit the data and consequently have a small spurious component), this connection allows the error in certain sequences of harmonic terms in gamma to be enhanced without unduly large effects on the fit of F to the model. Author

N74-17118*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECOMMENDED REFERENCE FIGURES FOR GEOPHYSICS AND GEODESY
M. A. Khan and John A Okeefe Oct. 1973 23 p refs Submitted for publication
(NASA-TM-X-70585; X-592-73-318) Avail: NTIS HC $4.25 CSCL 08E

Specific reference figures are recommended for consistent use in geophysics and geodesy. The selection of appropriate reference figure for geophysical studies suggests a relationship between the Antarctic negative gravity anomaly and the great shrinkage of the Antarctic ice cap about 4-5 million years ago. The depression of the south polar regions relative to the north polar regions makes the Southern Hemisphere flatter than the Northern Hemisphere, thus producing the third harmonic (pear-shaped) contribution to the earth's figure. Author

N74-17119*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF ELECTRON DENSITY PROFILES IN RELATION TO IONIZATION SOURCES AND GROUND-BASED RADIO WAVE ABSORPTION MEASUREMENTS, PART 1
S. Gnanalingam and J. A. Kane Nov. 1973 76 p refs Submitted for publication
(NASA-TM-X-70586; X-625-73-355) Avail: NTIS HC $7.00 CSCL 20N

An extensive set of ground-based measurements of the diurnal variation of medium frequency radio wave adsorption and virtual height is analyzed in terms of current understanding of the D- and lower E-region ion production and loss process. When this is done a gross discrepancy arises, the source of which is not known. Author

N74-17120*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AVERAGE DAILY VARIATIONS IN THE MAGNETIC FIELD AS OBSERVED BY ATS-5
Thomas L. Skillman Washington Mar. 1974 44 p refs
(NASA-TN-D-7496; G-7338) Avail: NTIS HC $3.25 CSCL

04A

Hourly averages of the magnetic field components are determined and analyzed using the measurements of the magnetic field monitor aboard the ATS-5. The data covering the time period of September 1969 through September 1971 are sorted and analyzed for various Kp values, geomagnetic latitude of the subsolar point, and local time. Local time variations are harmonically analyzed, and amplitudes and phases are given up to the fourth harmonic. Author

N74-17121*# Virginia Inst. of Marine Science, Gloucester Point.

ON THE USE OF DRIFT BOTTLE AND SEABED DRIFTER DATA IN COASTAL MANAGEMENT

Christopher S. Welch and John J. Norcross Aug. 1973 23 p refs Submitted for publication

(Grant NGL-47-022-005)

(NASA-CR-136939; VIMS-Contrib-571; Rept-44) Avail: NTIS HC $4.25 CSCL 08C

The use of drift bottle and seabed drifter information for use in coastal management is discussed. The drift bottle/seabed drifter portion of VIMS project MACONS (Mid Atlantic Continental Shelf) is described as an example of how a comprehensive survey using drift bottles and seabed drifters provides data useful for coastal management. The data from MACONS are analyzed to answer specific questions of interest to several different coastal managers: a manager siting a deep oil port, one siting a sewage outfall, a manager responsible for setting up emergency beach protection procedures before an accident occurs, and a manager responsible for the environmental quality of a particular small section of coastline. Author

N74-17122+ Institut d'Aeronomie Spatiale de Belgique, Brussels.

AN OVERVIEW OF AERONOMIC PROCESSES IN THE STRATOSPHERE AND MESOSPHERE

M. Nicolet 1973 69 p refs Presented at the Second Gen. Sci. Assembly of Geomagnetism and Aeronomy (IAGA) Symp., Kyoto, 9-21 Sep. 1973 Submitted for publication

(Aeronomica-Acta-A-121-1973) Avail: NTIS HC $6.50

The discrepancy between theoretical and observational concentrations of ozone in the mesosphere and stratosphere can be explained by an effect of hydrogen compounds and of nitrogen oxides. Solar radiation dissociates water vapor and methane in the thermosphere and upper mesosphere. In the stratosphere the reaction of the excited oxygen atom with methane and nitrous oxide leads to the production of carbon monoxide with water vapor and nitric oxide, respectively. Hydrogen and water vapor molecules also react with electronically excited oxygen atom, leading to hydroxyl radicals. The reaction of OH with CH4, photodissociation of formaldehyde and the reaction between hydroperoxyl radicals and hydrogen atoms in the stratosphere and mesosphere produce H2. The ratio of the hydroxyl and hydroperoxyl radical concentrations cannot be determined with adequate precision and complicates the calculation of the destruction of ozone. Author (ESRO)

N74-17123# Naval Research Lab., Washington, D.C.

THE PHYSICS AND CHEMISTRY OF TWO NRL CODES FOR THE DISTURBED E AND F REGIONS Interim Report

A. W. Ali 4 Oct. 1973 32 p refs

(AD-769216; NRL-7578) Avail: NTIS CSCL 04/1

NRL has developed two computer codes to describe the ionization and deionization phenomena of the upper atmosphere. The detailed physics and the chemistry of these codes, called the Simple and the Master Codes, describe the disturbed E and F regions of the ionosphere. The Simple Code carries less species (atoms, molecules, and ions) than the Master Code, but both codes are used to calculate three temperatures-electron N2 vibrational, and heavy particle. Both codes agree with each other in electron density calculations to better than 20%. Author (GRA)

N74-17124# Service Central de Protection Contre les Rayonnements Ionisants, le Vesinet (France).

DETAILS OF RESULTS OF MEASUREMENT Annex to Monthly Report, Apr. 1973

1973 21 p In FRENCH

(SCPRI(RM)-4-1973-Suppl) Avail: AEC Depository Libraries HC $3.25

Measurement tables concerning the surveillance of the environment in France during August 1972 are presented. NSA

N74-17125# Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).

REMOTE SENSING OF EARTH RESOURCES. VIEWPOINTS OF EUROPEAN EARTH SCIENTISTS

T. S. Bowling, comp., S. R. Dauncey, comp., R. J. Haslam, comp., J. Noel, comp., J. Ogier, comp., B. Vidon, comp., Y. Vuillaume, comp., G. Weeksteen, comp., and H. Sturm, comp. Paris ESRO Jul. 1973 175 p Prepared jointly with Soc. d'Etudes Tech. et d'Entreprises Gen., Dornier-Werke G.m.b.H., Munich and Bur. de Rech. Geol. et Minieres, Paris

(Contract ESTEC-1787/72)

(ESRO-CR-276) Avail: NTIS HC $1.75

An inquiry was carried out among those members of the European geoscientific community who are interested in the remote sensing of earth resources. The objective was to obtain the opinions and advice of specialists in the ten ESRO member states on the following topics: interest and advisability of a European program of remote sensing; desirable objectives of such a program; and suggestions for its preparation and development. The results of the inquiry are given. ESRO

N74-17126# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

MAGNETOSPHERIC CHEMICAL RELEASE STUDY Final Technical Report

Billy M. McCormac, John E. Evans, Stephen B. Mende, and G. T. Davidson 1 Nov. 1973 107 p refs

(Contract N00014-73-C-0130; ARPA Order 2260)

(AD-769979) Avail: NTIS CSCL 04/1

Wave particle interactions in the magnetosphere can produce ULF and VLF amplification, affect the diffusion of energy from the magnetosphere to the ionosphere, and may affect the trapping of energetic electrons and protons. Chemical releases of barium or lithium may modify the wave particle interactions in the magnetosphere such that the phenomena can be better investigated and may lead to techniques for producing desired wave particle interactions. Under this study results of a barium release in the outer magnetosphere and OGO-5 satellite results have been reviewed to obtain guidance in planning future satellite experiments. The possibility of using cold plasma chemical releases to reduce trapped betas from nuclear detonations has been studied. Data on previous observations of electrons and protons in the magnetosphere have been collected. General requirements for satellite experiments are given. Author (GRA)

N74-17127# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

FURTHER STUDY OF 30-80 KM. IONIZATION PARAMETERS USING PARACHUTE BORNE PROBES Final Report, 28 Jun. 1968 - 30 Jun. 1972

Leslie C. Hale 27 Sep. 1973 9 p

(Contract DAHC04-68-C-0034; Grant DA-ARO(D)-31-124-71-G110)

(AD-770544; PSU-IRL-FR2; AROD-7430-8-E) Avail: NTIS CSCL 04/1

The analysis of data obtained previously during the solar eclipse of November 12, 1966, in Cassino, Brazil, was completed. The next major activity was the successful development and flight of the Lyman-alpha headlamp experiment to make direct measurements of nitric oxide density. A rocket experiment to measure the effects of supersonic velocity on probe measurements was performed on October 13, 1970, at night at White Sands Missile Range. The data showed that very large errors can be introduced by supersonic velocities. A synoptic program to study the variability of mesospheric ionization, particularly in winter, involved rocket measurements at White Sands Missile Range. GRA

N74-17128# Aerospace Corp., El Segundo, Calif. Lab. Operations.

A STUDY OF MAGNETOSPHERIC BOUNDARIES BY THE SIMULTANEOUS OBSERVATIONS OF SOLAR AND MAGNETOSPHERIC PARTICLES

J. Bernard Blake and Alfred L. Vampola 21 Nov. 1973 30 p refs
(Contract F04701-73-C-20-6)
(AD-770580; TR-0074(4260-20)-6; SAMSO-TR-73-359) Avail: NTIS CSCL 04/1

A study of magnetospheric boundaries was made employing simultaneous measurements of solar and magnetospheric electrons, protons and alpha particles during the solar particle event of 12 April 1969. The instruments aboard the spin-stabilized satellite OV1-19(1969126C) provided large energy ranges, numerous energy channels and detailed pitch-angle distributions (e(-), 24 channels, 53 keV-5.3 MeV; p(+), 20 channels, 185 keV-130 MeV; alpha(++), 5 channels, 850 keV-9.0 MeV). The 105 degree inclination of the OV1-19 gave boundary measurements at widely separated local times. (Modified author abstract) GRA

N74-17129# Stanford Research Inst., Menlo Park, Calif.
PROJECT COCHISE: CONCEPT AND STATUS
R. K. White Jan. 1973 19 p refs
(Contract DNA001-72-C-0143; DNA Proj. NWET-L25AAXY; SRI Proj. EGU-1928)
(AD-770051; SRI-EGU-TN-1928-A3; DNA-3073T) Avail: NTIS CSCL 04/1

The technical note is one of a series devoted to a brief description of scientific programs that contribute to an understanding of the physics and chemistry of the upper atmosphere under normal and disturbed conditions. This issue discusses one such program--the COld CHemi-excited Infrared Simulation Experiment (COCHISE). Author (GRA)

N74-17130# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
LIGHTNING WARNING SET TEST REPORT
Pio J. Petrocchi and Wilbur H. Paulsen 18 Jun. 1973 30 p (AF Proj. 6670)
(AD-770014; AFCRL-IP-190; AFCRL-TR-73-0370) Avail: NTIS CSCL 04/2

A lightning warning set (LWS) consisting of a lightning stroke counter and ranging unit in combination with a field mill for measurement of the local potential gradient was tested at Cape Kennedy during the summer of 1970. The AN/FPS-77 weather radar was used to calibrate the range channels and to track storm centers for verification of the data recorded on the LWS. These data are analyzed for determination of criteria that can best be used to provide advance warning of electrical hazards at the station and also to indicate when the hazard has abated and normal activities can be resumed. Author (GRA)

N74-17131# Stanford Research Inst., Menlo Park, Calif.
INCOHERENT SCATTER RADAR MEASUREMENTS IN THE UPPER ATMOSPHERE
R. K. White Nov. 1972 25 p refs
(Contract DNA001-72-C-0143; SRI Proj. EGU-1928; DNA Proj. NWET-L25AAXY)
(AD-769918; SRI-EGU-TN-1928-A1; DNA-3082T) Avail: NTIS CSCL 04/1

The technical note is one of a series devoted to a brief description of scientific programs that contribute to an understanding of the physics and chemistry of the upper atmosphere under normal and disturbed conditions. This issue discusses one such experiment--the DNA project 617 radar at the Chatanika, Alaska field site. Author (GRA)

N74-17132# Aerospace Corp., El Segundo, Calif.
A THREE DIMENSIONAL NUMERICAL MODEL OF THE UPPER ATMOSPHERE. VOLUME 1: FORMULATION AND MATHEMATICAL METHOD
Stephen P. Creekmoore, Joe M. Straus, Robert M. Harris, Barbara K. Cing, and Yam T. Chiu 30 Nov. 1973 60 p refs
(Contract F04701-73-C-0074)
(AD-770590; TR-0074(9260-06)-1-Vol-1; SAMSO-TR-73-387-Vol-1) Avail: NTIS CSCL 04/1

The mathematical formulation of a numerical model of the upper atmosphere is described. The model is three-dimensional nonlinear and is designed for the study of time-dependent as well as steady-state problems. The Galerkin method is used as an efficient alternative to finite-difference approaches. This allows many parametric calculations to be made with low resolution for a reasonable cost; it can also be used for high-resolution studies. The effects of viscosity, ion drag and Coriolis force are included, as well as those of the nonlinear terms in the equations of motion. The present report serves as an introduction to a series of volumes describing calculations made using this model, in which the density, temperature and wind fields are determined in various stages of approximation. Author (GRA)

N74-17133# GCA Corp., Bedford, Mass. GCA Technology Div.
TMA (TRIMETHYL-ALUMINUM) WINDS PROGRAM Final Report, 28 Nov. 1972 - 28 May 1973
John F. Bedinger Sep. 1973 16 p refs
(Contract F19628-73-C-0087; AF Proj. 6690)
(AD-770093; GCA-TR-73-3-A; AFCRL-TR-73-0347) Avail: NTIS CSCL 04/1

A TMA trail was ejected from a Paiute-Tomahawk rocket over the Poker Flat sounding Rocket Range during the night of March 26, 1973. The purpose of the trail was to measure winds in the thermosphere as a part of a coordinated program consisting of a large number of rocket and ground based measurements. However, due to local cloudiness, useful data were obtained from only one photographic site. Author (GRA)

N74-17134# Hydronautics, Inc., Laurel, Md.
WIND-INDUCED DRIFT CURRENTS
Jin Wu Aug. 1973 43 p refs
(Contract N00014-73-C-0091; NR Proj. 083-281)
(AD-770585; TR-73-03-3) Avail: NTIS CSCL 08/3

Systematic measurements of drift currents below, and of airflows above, the air-water interface were performed under various wind conditions. The current near but not immediate to the water surface is found to follow Karman-Prandtl (logarithmic) velocity distribution. The current immediate to the water surface tends to vary linearly with the depth. (Modified author abstract) GRA

N74-17135# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
STUDIES OF ATMOSPHERIC PROCESSES Semiannual Technical Report No. 3
Edward R. Fisher, Ralph H. Kummler, Richard Marriott, and Pieter K. Rol 15 Dec. 1972 63 p refs
(Contract F19628-72-C-0007; ARPA Order 1856; AF Proj. 8692)
(AD-769961; AFCRL-TR-73-0287; SATR-3) Avail: NTIS CSCL 07/4

The report describes a detailed mechanistic study of the chemiluminescent reaction of ethylene with atomic oxygen. The 2.7 micrometer emission was studied in a discharge-flow tube system. Also briefly described are a theoretical determination of molecular vibration excitation by collisions and a preliminary molecular beam study of the same topic. GRA

N74-17136# Naval Postgraduate School, Monterey, Calif. Dept. of Operations Research and Administrative Sciences.
THE VARIATION OF EARTH TIDES AS A TRIGGERING MECHANISM IN EARTHQUAKES M.S. Thesis
Richard Arthur Corradini Sep. 1973 40 p refs
(AD-769758) Avail: NTIS CSCL 08/7

Earthquake data from Central California over the period January 1, 1969, to December 31, 1971, and from Western Nevada over the period August 31, 1954, to December 31, 1961, have been analyzed to investigate the hypothesis that the earth tides may be the triggering mechanism for the occurrence of earthquakes. One method used compared the tidal components and the component rates-of-change at the time and location of actual earthquakes to those for random events uniformly generated over the same time period. A second method compared the differences in the earth tides computed across the breadth of a fault zone at the time of actual earthquakes to the differences at the times of random events uniformly generated over the same time period. Statistical tests were performed to see if the distributions from the actual events were the same as the corresponding distributions from the randomly generated events. Author (GRA)

N74-17137# Naval Postgraduate School, Monterey, Calif.
CORRELATION COEFFICIENTS CALCULATED ON A WORLD WIDE BASIS BETWEEN OBSERVED SECCHI DEPTHS AND OTHER SIMULTANEOUSLY MEASURED STANDARD OCEANOGRAPHIC PARAMETERS M.S. Thesis
Patrick Joseph Brown Mar. 1973 121 p refs
(AD-769427) Avail: NTIS CSCL 08/10

The distributions of Secchi depths (i.e. water transparency) with simultaneously measured standard oceanographic parameters on file at the National Oceanographic Data Center are surveyed on a global basis. An inventory of many of the oceanographic parameters is given for all Marsden squares. Correlation coefficients between Secchi depths and eleven other parameters are also tabulated. Linear regression equations for some twenty-one selected ocean areas relating Secchi depth and the other parameters are presented, and in some cases plotted. No simple and consistent relations between Secchi depth and other parameters are evident; however, several trends are noted. Forel color and oxygen measurements show trends toward an inverse proportionality with Secchi depths while bottom depth data indicate a possible direct proportionality. Author (GRA)

N74-17138# Perception Technology Corp., Winchester, Mass.
USE OF SYMBOLIC MANIPULATION TECHNIQUES TO EXAMINE GRAVITATIONAL AND UNIFIED FIELD THEORIES Technical Report, 30 Jun. - 30 Nov. 1973
Huseyin Yilmaz and Richard Pavelle 30 Nov. 1973 46 p refs
(Contract DAHC15-73-C-0369; ARPA Order 2465)
(AD-770160; TR-1) Avail: NTIS CSCL 20/10

This is the six month technical report for the contract. Following the report summary are seven appendices. The first is a published description of the New Theory of Gravitation and its ramification while the subsequent six are concerned with research performed during the first five months of the present contract. (Modified author abstract) GRA

N74-17139# Pacific Missile Range, Point Mugu, Calif.
TIDAL AND LUNAR DATA FOR POINT MUGU, SAN NICOLAS ISLAND, AND THE BARKING SANDS AREA DURING 1974
Robert DeViolini 15 Nov. 1973 28 p
(AD-769681; PMR-TP-73-2) Avail: NTIS CSCL 08/3

Basic lunar and tidal data for Point Mugu, San Nicolas Island, and the Barking Sands area during 1974 are provided. The data presented are (1) tidal data; (2) times of moonrise and moonset; and (3) times of lunar phases. Author (GRA)

N74-17140# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
SOLAR ELECTRON ACCESS TO THE MAGNETOSPHERE
Alfred L. Vampola 24 Aug. 1973 40 p refs
(Contract F04701-73-C-0074)
(AD-770319; TR-0074(4260-20)-5; SAMSO-TR-73-347) Avail: NTIS CSCL 04/1

The problem of solar flare electron access to the geomagnetosphere is reviewed. The lack of a definitive solution to this problem is found to be due to the inadequacy of the measurements that have been published to date rather than to the nature of the problem. The data that have been published support the interconnection model of the magnetosphere. Author (GRA)

N74-17141# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ENVIRONMENTAL IMPACT OF B-1 EMISSIONS IN THE STRATOSPHERE
C. G. Stergis 10 Oct. 1973 34 p refs
(AD-770016; AFCRL-AFSG-275; AFCRL-TR-73-0608) Avail: NTIS CSCL 13/2

This is a compendium of three papers aimed at the question; What will be the environmental impact of a fleet of B-1 aircraft flying in the stratosphere. The three papers are; (1) Effects of the B-1 on Ozone and on Transmitted UV; (2) Visible and Infrared Effects of Molecular and Particulate B-1 Emissions; and (3) Assessment of the Impact of the B-1 Exhaust Emissions on Local and Global Changes in Weather. Author (GRA)

N74-17142# Army Foreign Science and Technology Center, Charlottesville, Va.
RADIOACTIVITY OF THE ATMOSPHERE AND SURFACE OF THE EARTH
S. G. Malakhova and K. P. Makhonko 15 Aug. 1973 182 p refs Transl. into ENGLISH from Tr. Inst. Eksperimen. Meteorol. (USSR), no. 14, 1971 p 145
(AD-770510; FSTC-HT-23-586-73) Avail: NTIS CSCL 04A

The collection of articles considers questions of the natural radioactivity of the troposphere and radioactive contamination of it and of the earth's surface by products of atomic explosions, as well as questions of the use of radioactive tracers in meteorological studies. The first section, deals with natural radioactivity of the atmosphere. The second section is devoted to global radioactive contamination of natural media. The third section deals with physico-chemical properties of aerosols. The fourth section is devoted to problems of measurement methodology. (Modified author abstract) GRA

N74-17143# Army Foreign Science and Technology Center, Charlottesville, Va.
SCATTERING OF LIGHT IN THE ATMOSPHERE, PART 1
G. Sh. Livshits 21 Aug. 1973 210 p refs Transl. into ENGLISH of Tr. Akad. Nauk Kaz. SSR, Astrofiz. Inst. (Alma Ata), v. 6, 1965
(AD-770521; FSTC-HT-23-230-73-Pt-1) Avail: NTIS CSCL 04/1

The work is devoted to study of the basic factors determining the processes of light scattering in the terrestrial atmosphere. The results of sky brightness observations are compared with theoretical calculations. On the basis of data of direct measurement, the role of light reflected from the underlying surfaces, pure absorption, curvature of the earth, stability of the atmosphere, anisotropy and other factors are analysed. The methods of determination of atmospheric transparency, monitoring stability, scattering indicatrix, and the like are examined. GRA

N74-17144# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
BIBLIOGRAPHY ON COLD REGIONS SCIENCE AND TECHNOLOGY, VOLUME 27, PART 1
Jul. 1973 223 p refs
(AD-768099; CRREL-12-27-1) Avail: NTIS CSCL 08/12

The Bibliography on Cold Regions Science and Technology, CRREL Report 12, was first published in 1951 and is a continuing publication of the Cold Regions Bibliography Project in the Science and Technology Division of the Library of Congress. It is sponsored by and prepared for the Cold Regions Research and Engineering Laboratory (formerly Snow, Ice and Permafrost Research Establishment) of the U.S. Army Corps of Engineers. The present volume contains material accessioned between July 1972 and June 1973. The volume consists of two parts, each separately bound. Pt. 1 contains the full citation of 3104 items, in many cases with abstracts. GRA

N74-17145# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
BIBLIOGRAPHY ON COLD REGIONS SCIENCE AND TECHNOLOGY, VOLUME 27, PART 2
Jul. 1973 232 p refs
(AD-768100; CRREL-12-27-2) Avail: NTIS CSCL 08/12

The report, part two of a two part series, contains the author and subject indexes. GRA

N74-17146# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Technical Translation Branch.
ABSOLUTE GRAVITY MEASUREMENTS WITH REVERSIBLE PENDULUMS AT POTSDAM, 1968-1969
R. Schueler, G. Harnisch, H. Fischer, and R. Frey Jan. 1973 259 p refs Transl. into ENGLISH of Veroeffentl. des Zentralinst. Phys. der Erde (East Berlin), no. 10, 1971 193 p
(AD-762831; DMAAC-TC-1872) Avail: NTIS CSCL 08/5

A new absolute determination of the acceleration due to gravity was made at the former Geodatisches Institut Potsdam (since 1969 part of the Zentralinstitut Physik der Erde), using the reversible pendulum method. Beside essential theoretical fundamentals of the reversible pendulum method the publication presented here includes a detailed description of facts concerning

the devices which have been used, their results and the way of interpretation. In addition the determinations of absolute gravity since the work of Kuhnen and Furtwangler are summarized and compared with the results from the recent reversible pendulum measurements performed at Potsdam. Author (GRA)

N74-17147# Ohio State Univ., Columbus. Dept. of Geodetic Science.
GRAVITY GRADIENTS AND THREE DIMENSIONAL NET ADJUSTMENTS WITHOUT ELLIPSOIDAL REFERENCE
Erik Grafarend Apr. 1973 140 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-769975; DGS-202; AFCRL-TR-73-0534; SR-8) Avail: NTIS CSCL 08/5

The report analyzes the practical applicability of the Marussi transformation from natural nonunique coordinates into the unique coordinates astronomical longitude and latitude, and geopotential by means of gravity gradients and the euclidean norm of the gravity vector as integrating factors. If point errors of about plus or minus 10 m are tolerated the r.m.s. error of gravity gradients is found to be about plus or minus for point distances of about 15 km and pole free latitudes. Analogous values are plus or minus and plus or minus 0.1 E, plus or minus 10 cm and plus or minus 0.01 E approximately. A very detailed error analysis for the Marussi transformation is given, completed by an example for a three dimensional net adjustment based on the Frobenius theorem and available gravity gradient information. Author (GRA)

N74-17148# Naval Research Lab., Washington, D.C. Space Sciences Div.
MEASUREMENTS OF THE DISTRIBUTION AND VOLUME OF SEA-SURFACE OIL SPILLS USING MULTIFREQUENCY MICROWAVE RADIOMETRY Interim Report
James P. Hollinger and Robert A. Mennella May 1973 14 p refs
(AD-762753; NRL-7512) Avail: NTIS HC $3.00 CSCL 13/2

Multifrequency passive microwave measurements from aircraft have been made of eight controlled marine oil spills. It was found that over 90 percent of the oil was generally confined in a compact region with thicknesses in excess of 1 mm and comprising less than 10 percent of the area of visible slick. It is shown that microwave radiometry offers a means to measure the distribution of oil in sea surface slicks and to locate the thick regions and measure their volume on an all-weather, day-or-night, and realtime basis. Author (GRA)

N74-17149# Texas Univ., Austin. Electronics Research Center.
AN EXPERIMENTAL SYSTEM FOR AUDIO-MAGNETOTELLURIC MEASUREMENTS Interim Report
John G. Pound, F. X. Bostick, Jr., and H. W. Smith 12 Jun. 1973 102 p refs
(Contract N00014-67-A-0126-0004; Grant NSF GA-38827)
(AD-769275/9GA; TR-151) Avail: NTIS

An experimental, frequency domain system for audio-magnetotelluric (AMT) measurements is described along with appropriate electromagnetic field theory and data processing techniques. The system employs an induction coil magnetic field sensor, lead metal electrodes for electric field detection, and a pair of synchronized wave analyzers for frequency selection. Data is displayed on a storage oscilloscope and stored on Polaroid photographs. Sources of the earth's natural field are discussed with particular reference to possible seasonal variations in the strength of the audio-magnetotelluric signal. Also, source distance requirements are included, and the surface impedance of a stratified earth model is derived. Finally, results of AMT measurements in Central Texas are presented. Author (GRA)

N74-17150# Naval Postgraduate School, Monterey, Calif.
NUMERICAL INVESTIGATION OF BERING SEA DYNAMICS M.S. Thesis
Jerry Craig Bacon Sep. 1973 61 p refs
(AD-769428) Avail: NTIS CSCL 08/3

Galt's (1972) Arctic numerical model was used to explore the significant dynamics of the Bering Sea. The model was set up and tested for numerical stability. Climatological wind fields were used along with source-sink exchange transports to drive the model. The runs investigated the results of adding or deleting bottom friction, non-linearities and bathymetry. The results obtained by the model were compared to a circulation pattern proposed by Hughes (1972). The model showed that the circulation is strongly bathymetry-dependent and primarily driven by the sources and sinks. Author (GRA)

N74-17151# Hydronautics, Inc., Laurel, Md.
EFFECTS OF WIND-INDUCED DRIFT CURRENTS ON THE PROPAGATION OF SURFACE WAVES
Jin Wu Sep. 1973 29 p refs
(Contract N00014-72-C-0509; NR Proj. 062-472)
(AD-770145; TR-7211-3) Avail: NTIS CSCL 08/3

Phase velocities were measured of dominant waves generated by wind and of simple progressive waves, generated mechanically, under wind. The results indicate that the wind-induced drift current has a significant effect on the phase velocity of short gravity waves. The effect varies inversely with wavelength and directly with fetch. Author (GRA)

N74-17152# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DIURNAL VARIATIONS IN THE D REGION DURING PCA EVENTS, 42
W. Swider and T. J. Keneshea 28 Aug. 1973 50 p refs Repr. from Proc. of COSPAR Symp. on Solar Particle Event of Nov. 1969 (AFCRL-72-0407)
(AF Proj. 8605)
(AD-766978; AFCRL-TR-73-0545; AFCRL-72-0407) Avail: NTIS CSCL 04/1

Extensive computations have been performed in order to simulate the diurnal behavior of the D region during PCA events. Computations using 98 reactions with only NO+ and O2+ as positive ions apparently yield too much 30 MHz riometer absorption. Nevertheless, the argument of Swider et al (1971) is substantiated that this simple positive ion chemistry is sufficient regarding the deduction of the nighttime electron concentration profile. Expansion of the computer code to 195 reactions, including species like 9H30+.H20n provides more reasonable results as far as the positive ion chemistry is concerned since such ions are known to exist in the D region. However, too few electrons appear to be generated in the 50-65 km region, which is indicative of insufficient knowledge of the negative ion chemistry. (Modified author abstract) GRA

N74-17546 Observatoire de Paris-Meudon (France).
TRAPOL EXPERIMENTAL RESULTS: DETERMINATION OF THE POLE USING SINGLE STATION DOPPLER OBSERVATIONS [RESULTATS DE L'EXPERIENCE TRADPOL. DETERMINATION DU POLE PAR DES OBSERVATIONS DOPPLER EN UNE SEULE STATION]
Nicole Capitaine *In* Groupe de Rech. de Geodesie Spatiale Bull. No. 9 Jul. 1973 p 1-31 refs In FRENCH; ENGLISH summary
(For availability see N74-17545 08-30)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-17153* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REAL TIME MOVING SCENE HOLOGRAPHIC CAMERA SYSTEM Patent
Robert L. Kurtz, inventor (to NASA) Issued 14 Aug. 1973 11 p Filed 2 Jun. 1971
(NASA-Case-MFS-21087-1; US-Patent-3,752,566;
US-Patent-Appl-SN-149283; US-Patent-Class-350-3.5) Avail: US Patent Office CSCL 14B

A holographic motion picture camera system producing resolution of front surface detail is described. The system utilizes a beam of coherent light and means for dividing the

beam into a reference beam for direct transmission to a conventional movie camera and two reflection signal beams for transmission to the movie camera by reflection from the front side of a moving scene. The system is arranged so that critical parts of the system are positioned on the foci of a pair of interrelated, mathematically derived ellipses. The camera has the theoretical capability of producing motion picture holograms of projectiles moving at speeds as high as 900,000 cm/sec (about 21,450 mph). Official Gazette of the U.S. Patent Office

N74-17154# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
PRODUCING HIGH-QUALITY NEGATIVES FROM ERTS BLACK-AND-WHITE TRANSPARENCIES
Richard J. Myhre 1973 6 p refs
(PSW-287) Avail: NTIS HC $4.00

A method was devised for producing high-quality black-and-white negatives quickly and efficiently from dense transparencies originating from Earth Resources Technology Satellite imagery. Transparencies are evaluated on a standard light source to determine exposure and processing information needed for making negatives. A System ASA Rating was developed by testing and selecting combinations of film, light sources, and developer. Changes in film density and contrast of negatives owing to reciprocity effects are controlled by calculating adjustments in exposure and development. The method described can be used in relatively small darkrooms without expensive equipment. Its usefulness was demonstrated in a high-altitude photo mission over the Black Hills National Forest, South Dakota. Author

N74-17155*# Radio Corp. of America, Princeton, N.J.
CATHODOCHROMIC STORAGE DEVICE Final Report, 3 Apr. 1968 - 2 Apr. 1969
D. R. Bosomworth and W. H. Moles 2 Apr. 1969 63 p refs
(Contract NAS5-10636)
(NASA-CR-132920) Avail: NTIS HC $6.25 CSCL 14B

A memory and display device has been developed by combing a fast phosphor layer with a cathodochromic layer in a cathode ray tube. Images are stored as patterns of electron beam induced optical density in the cathodo-chromic material. The stored information is recovered by exciting the backing, fast phosphor layer with a constant current electron beam and detecting the emitted radiation which is modulated by absorption in the cathodochromic layer. The storage can be accomplished in one or more TV frames (1/30 sec each). More than 500 TV line resolution and close to 2:1 contrast ratio are possible. The information storage time in a dark environment is approximately 24 hours. A reconstituted (readout) electronic video signal can be generated continuously for times in excess of 10 minutes or periodically for several hours. Author

N74-17156*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
INVESTIGATION OF PHOTOELECTRON SPECTROSCOPY Final Report
James A. R. Samson Feb. 1973 50 p refs
(Contract NAS5-23054)
(NASA-CR-132928) Avail: NTIS HC $5.50 CSCL 14B

The problem of obtaining true and meaningful branching ratios from the photoelectron spectra is investigated. The problem consists of understanding the transmission of an electron energy analyzer for electrons with different energies, understanding the effects of using partially polarized radiation from different vacuum monochromators, and in understanding the effects of the angular distribution of photoelectrons ejected from different orbitals. An analysis of the degree of polarization of monochromatic radiation and of the problem of varying angular distributions led to the construction of a cylindrical mirror electron energy analyzer set at the special angle of 54 deg 44 min so that no discrimination would occur for electrons of different angular distributions. With the analyzer properly calibrated for transmission of electrons of different energies, data were taken at several wavelengths and for several atmospheric gases. Author

N74-17157*# Missouri Univ., Kansas City.
STUDY OF AIR POLLUTANT DETECTORS Final Technical Report
P. L. Gutshall and C. Q. Bowles Jan. 1974 49 p refs
(Contract NAS2-7078)
(NASA-CR-114719) Avail: NTIS HC $5.50 CSCL 14B

The application of field ionization mass spectrometry (FIMS) to the detection of air pollutants was investigated. Current methods are reviewed for measuring contaminants of fixed gases, sulfur compounds, nitrogen oxides, hydrocarbons, and particulates. Two enriching devices: the dimethyl silicone rubber membrane separator, and the selective adsorber of polyethylene foam were studied along with FIMS. It is concluded that the membrane enricher system is not a suitable method for removing air pollutants. However, the FIMS shows promise as a useable system for air pollution detection. F.O.S.

N74-17158*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY TEST OF A SOLID STATE SPIN-SCAN PHOTO-IMAGING SYSTEM
N. P. Laverty 14 Dec. 1973 192 p refs
(Contract NAS2-7592)
(NASA-CR-114733; TRW-23671-6001-TU-00) Avail: NTIS HC $12.75 CSCL 14E

The feasibility of using a solid-state photo-imaging system to obtain resolution imagery from a Pioneer-type spinning spacecraft in future exploratory missions to the outer planets is discussed. Evaluation of the photo-imaging system performance, based on electrical video signal analysis recorded on magnetic tape, shows that the signal-to-noise (S/N) ratios obtained at low spatial frequencies exceed the anticipated performance and that measured modulation transfer functions exhibited some degradation in comparison with the estimated values, primarily owing to the difficulty in obtaining a precise focus of the optical system in the laboratory with the test patterns in close proximity to the objective lens. A preliminary flight model design of the photo-imaging system is developed based on the use of currently available phototransistor arrays. Image quality estimates that will be obtained are presented in terms of S/N ratios and spatial resolution for the various planets and satellites. Parametric design tradeoffs are also defined. Author

N74-17159*# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
UV PHOTOGRAPHY OF THE EARTH AND THE MOON Final Report, 1 Mar. 1971 - 30 Sep. 1973
30 Sep. 1973 45 p refs
(Contract NAS9-11640)
(NASA-CR-134189) Avail: NTIS HC $5.25 CSCL 14E

The fundamental aim of this experiment was the acquisition of ultraviolet photographs of the earth and the moon that could be used to interpret similar imagery of Mars and Venus. Venus shows no markings whatever when viewed in visible light, a phenomenon that is in keeping with its immensely thick atmosphere and perpetual cloud cover, but in the near ultraviolet, the planet exhibits low contrast markings which vary in position and appearance with time. Mars posed just the opposite problem from Venus at wavelengths below 4500 A, Mars shows very little detail, sometimes none at all, whereas at longer wavelengths, the surface is clearly visible. Occasionally observers have reported that this obscuration has lifted and the ground has become visible at the shorter wavelengths as well. Such events have been labeled blue clearings and led to the suggestion that the ultraviolet obscuration was caused by an atmospheric haze. Mariner 6 and 7 observations of Mars failed to find such a haze and lent support to the alternative view that ascribed the absence of detail on UV photographs to a simple lack of contrast between Martian surface features at these wavelengths. Author

N74-17160*# Texas Univ., Dallas.
LUNAR ORBITAL MASS SPECTROMETER EXPERIMENT Final Report
W. P. Lord 15 Sep. 1971 193 p refs
(Contract NAS9-10410)
(NASA-CR-134185; Doc-151-070) Avail: NTIS HC $12.75 CSCL 14B

The design, development, manufacture, test and calibration of five lunar orbital mass spectrometers with the four associated ground support equipment test sets are discussed. A mass spectrometer was installed in the Apollo 15 and one in the Apollo 16 Scientific Instrument Module within the Service Module. The Apollo 15 mass spectrometer was operated with collection

of 38 hours of mass spectra data during lunar orbit and 50 hours of data were collected during transearth coast. The Apollo 16 mass spectrometer was operated with collection of 76 hours of mass spectra data during lunar orbit. However, the Apollo 16 mass spectrometer was ejected into lunar orbit upon malfunction of spacecraft boom system just prior to transearth insection and no transearth coast data was possible. Author

N74-17161*# IIT Research Inst., Chicago, Ill.
FEASIBILITY MODEL OF A HIGH RELIABILITY FIVE-YEAR TAPE TRANSPORT, VOLUME 1 Final Technical Report, 5 Jan. 1972-5 Nov. 1973
R. L. Eshleman, A. P. Meyers, W. A. Davidson, R. C. Gortowski, and M. E. Anderson Oct. 1973 33 p
(Contract NAS5-21692; IITRI Proj. E6225)
(NASA-CR-132901) Avail: NTIS HC $4.75 CSCL 14C

The development, performance, and test results for the spaceborne magnetic tape transport are discussed. An analytical model of the tape transport was used to optimize its conceptual design. Each of the subsystems was subjected to reliability analyses which included structural integrity, maintenance of system performance within acceptable bounds, and avoidance of fatigue failure. These subsystems were also compared with each other in order to evaluate reliability characteristics. The transport uses no mechanical couplings. Four drive motors, one for each reel and one for each of two capstans, are used in a differential mode. There are two hybrid, spherical, cone tapered-crown rollers for tape guidance. Storage of the magnetic tape is provided by a reel assembly which includes the reel, a reel support structure and bearings, dust seals, and a dc drive motor. A summary of transport test results on tape guidance, flutter, and skew is provided. Author

N74-17162*# IIT Research Inst., Chicago, Ill.
FEASIBILITY MODEL OF A HIGH RELIABILITY FIVE-YEAR TAPE TRANSPORT. VOLUME 3: APPENDICES Report for 5 Jan. 1972 - 5 Nov. 1973
A. P. Meyers, W. A. Davidson, and R. C. Gortowski Oct. 1973 112 p
(Contract NAS5-21692; IITRI Proj. E6225)
(NASA-CR-132904) Avail: NTIS HC $8.75 CSCL 14C

Detailed drawings of the five year tape transport are presented. Analytical tools used in the various analyses are described. These analyses include: tape guidance, tape stress over crowned rollers, tape pack stress program, response (computer) program, and control system electronics description. K.M.M.

N74-17163*# CBS Labs., Stamford, Conn.
THE APPLICABILITY OF FRAME IMAGING FROM A SPINNING SPACECRAFT. VOLUME 1: SUMMARY REPORT
Robert A. Botticelli, Richard O. Johnson, and Gerald N. Wallmark 30 Jun. 1973 29 p
(Contract NAS2-7101)
(NASA-CR-114637) Avail: NTIS HC $4.50 CSCL 14E

A detailed study was made of frame-type imaging systems for use on board a spin stabilized spacecraft for outer planets applications. All types of frame imagers capable of performing this mission were considered, regardless of the current state of the art. Detailed sensor models of these systems were developed at the component level and used in the subsequent analyses. An overall assessment was then made of the various systems based upon results of a worst-case performance analysis, foreseeable technology problems, and the relative reliability and radiation tolerance of the systems. Special attention was directed at restraints imposed by image motion and the limited data transmission and storage capability of the spacecraft. Based upon this overall assessment, the most promising systems were selected and then examined in detail for a specified Jupiter orbiter mission. The relative merits of each selected system were then analyzed, and the system design characteristics were demonstrated using preliminary configurations, block diagrams, and tables of estimated weights, volumes and power consumption. Author

N74-17164*# CBS Labs., Stamford, Conn.
THE APPLICABILITY OF FRAME IMAGING FROM A SPINNING SPACECRAFT. VOLUME 2: TECHNICAL REPORT
Robert A. Botticelli, Richard O. Johnson, and Gerald N. Wallmark 30 Jun. 1973 333 p refs
(Contract NAS2-7107)
(NASA-CR-114638) Avail: NTIS HC $19.75 CSCL 14E
For abstract, see N74-17163.

N74-17165*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LARGE SPACE TELESCOPE (LST) POINTING CONTROL SYSTEM (PCS) ANALYTICAL ADVANCED TECHNICAL DEVELOPMENT (ATD) PROGRAM
Sherman M. Seltzer 14 Feb. 1974 20 p refs
(NASA-TM-X-64806) Avail: NTIS HC $4.00 CSCL 14B

The large space telescope (LST) pointing control system (PCS) advanced technical development (ATD) program is described. The approach used is to describe the overall PCS development effort, showing how the analytical ATD program elements fit into it. Then the analytical ATD program elements are summarized. Author

N74-17166# National Aeronautical Lab., Bangalore (India).
THE VARIANCE AS A CRITERION FOR DEFOCUSING IN POWDER DIFFRACTOMETRY
C. Balasingh and A. K. Singh Dec. 1971 17 p refs
(NAL-TN-37) Avail: NTIS HC $4.00

The focusing condition in a powder diffractometer was examined by considering the variance due to geometrical factors of diffraction line profile as a function of R, the distance of the receiving slit from the diffractometer axis. The value of R corresponding to minimum variance is taken as the point of focus. The method has been exemplified in the case of a flat sample and diffractometer geometry used in stress measurement (which is similar to the Seemann-Bohlin geometry). Author

N74-17167*# Texas Instruments, Inc., Dallas. Central Research Labs.
CHARGE-COUPLED DEVICE IMAGE SENSOR STUDY Final Technical Report
3 Dec. 1973 100 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953673)
(NASA-CR-136936) Avail: NTIS HC $8.00 CSCL 14B

The design specifications and predicted performance characteristics of a Charge-Coupled Device Area Imager and a Charge-Coupled Device Linear Imager are presented. The Imagers recommended are intended for use in space-borne imaging systems and therefore would meet the requirements for the intended application. A unique overlapping metal electrode structure and a buried channel structure are described. Reasons for the particular imager designs are discussed. Author

N74-17168*# Fairchild Camera and Instrument Corp., Mountain View, Calif. Semiconductor Components Group.
CHARGE COUPLED DEVICE IMAGE SENSOR STUDY Final Report
Feb. 1974 85 p Prepared for JPL
(Contracts NAS7-100; JPL-953674)
(NASA-CR-136937) Avail: NTIS HC $7.25 CSCL 14B

An evaluation of a charge-coupled device (CCD) image sensors for use in spacecraft-borne imaging systems was conducted. The study resulted in design recommendations for two sensors, an approximately 500 times 500 element imaging device and a 1 times 190 element linear imaging device with a 190 times 121 buffer store. Emphasis was placed on the higher resolution, area-imaging sensor. The objectives of the proposed sensors are listed, results of the experiments are analyzed, and estimates of the device performance are presented. A summary of the major technical recommendations is included. Author

N74-17169# Cranfield Inst. of Technology (England).
EVALUATION OF THE BASIC PERFORMANCE CHARACTERISTICS OF AN INSTRUMENTATION SYSTEM
V. Klein Nov. 1973 41 p refs
(Cranfield-Aero-22) Avail: NTIS HC $5.25

The performance of an instrumentation system is defined in terms of the static and dynamic performance characteristics. The former generally represents nonlinear and statistical effects in the otherwise linear differential equations, the latter generally

represents the dynamic behaviour of a system. The overall performance of an instrumentation system is then judged by the superposition of the static and dynamic characteristics, even though this approach is only the approximate one. The basic static performance characteristics of an instrumentation system are represented by its precision and accuracy. The accuracy of a system is further influenced by and, therefore, dependent upon such other characteristics as sensitivity, working range, nonlinearity, secondary sensitivity and hysteresis. Author

N74-17170# California Univ., Livermore. Lawrence Livermore Lab.
REVIEW OF NEUTRON DETECTION METHODS AND INSTRUMENTS
A. Lorenz 5 Sep. 1973 53 p refs
(Contract W-7405-eng-48)
(UCID-16325) Avail: NTIS HC $4.75

This report is an overview of neutron detection methods and neutron detector types. A brief description of the neutron-induced reactions most useful in neutron detection and a discussion of several classes of neutron detector types and their applications are included, as is an extensive bibliography. A list of commercially available neutron detectors and their characteristics is appended. Author (NSA)

N74-17171# Bendix Corp., Baltimore, Md. Environmental Science Div.
ENVIREC Final Report
W. H. Kinneman May 1973 24 p
(Contract HSM-99-71-37)
(PB-223006/8; NIOSH-TR-039-73) Avail: NTIS HC $3.25 CSCL 14C

An instrument for monitoring and recording environmental stress was developed. Basically, the instrument (ENVIREC) is a portable, battery powered, data acquisition system designed for unattended operation for eight hours. The unit measures the environmental parameters of dry-bulb temperature, wet-bulb temperature, globe temperature, and air velocity using plug-in sensors mounted on the top of the instrument. The sensor outputs are scanned, conditioned, scaled, converted to digital form, and recorded on magnetic cassette tape at fifteen minute intervals. The data being recorded can be displayed on the front panel digital display. Recorded information can be played back and observed on the digital display or converted to an IBM compatible tape using the tape reformatter unit. GRA

N74-17172# Saab-Scania, Linkoping (Sweden).
PASSIVE MICROWAVE RADIOMETRY AND ITS POTENTIAL APPLICATIONS TO EARTH RESOURCES SURVEYS. BASIC PHYSICS
S. Axelsson and O. Edvardsson Paris ESRO Feb. 1973 107 p refs
(Contract ESTEC-1411/71)
(ESRO-CR-71) Avail: NTIS HC $8.50

Since objects with a temperature above absolute zero emit electromagnetic energy, sensing and analysis of this radiation make it possible to obtain information about objects at a distance. In practice, there are various sources of errors that affect measurement accuracy such as attenuation by the atmosphere and reflection of energy from other sources (sun, radar, etc). Various ways of avoiding or minimizing these errors are discussed together with errors arising from the limitations of the sensor. Finally, the connection between user requirements and system parameters is discussed. ESRO

N74-17173# Research Inst. of National Defence, Stockholm (Sweden).
PASSIVE MICROWAVE RADIOMETRY AND ITS POTENTIAL APPLICATIONS TO EARTH RESOURCES SURVEYS. MICROWAVE EMISSIONS FOR NATURAL MATERIALS
Torleiv Orhaug Paris ESRO May 1973 79 p refs
(Contract ESTEC-1411/71)
(ESRO-CR-74) Avail: NTIS HC $7.00

The theory of generation of thermal microwave noise from solid and gaseous objects is summarized. The influence of various material properties is discussed in detail, particularly for a conducting glossy object, where the Fresnel coefficient can be used for predicting brightness properties. The effect and characteristics of atmospheric noise are discussed, and examples of microwave observations of atmospheric noise are given. The scattering properties of an object having a rough surface are discussed, emphasis being laid on the limitations of theoretical analysis. The generation of noise from rough surfaces is also treated. The polarization effect to be expected from glossy and rough surfaces is considered and the influence of atmospheric noise discussed. The effects of thermal noise caused by sub surface inhomogeneities and by time-varing heating are discussed. Finally, a summary of present programs and present knowledge in this field is given, together with recommendations for future work. ESRO

N74-17174# Royal Aircraft Establishment, Farnborough (England).
EVALUATION OF A LIQUID MERCURY FLOWMETER FOR USE WITH ION THRUSTERS
J. W. Pye and S. Brabner Aug. 1973 31 p refs
(RAE-TR-73086; BR36508) Avail: NTIS HC $4.75

The development and performance of a liquid mercury flowmeter, based on a thermal operating principle, are described. The sensitivity, in terms of differential temperature change as a function of mass flow rate, was measured and found to be 18 C (mg/s) to the minus 1, with good linearity. ESRO

N74-17175# Interuniversitair Reactor Instituut, Delft (Netherlands).
DETERMINATION OF THE DIAMETER OF TWO MONODISPERSE LATEX SPHERES [BEPALING VAN DE DIAMETER VAN TWEE MONODISPERSE LATICES]
H. W. J. Bierhuizen and G. A. Ferron Nov. 1973 9 p refs In DUTCH
(IRI-190-73-2) Avail: NTIS HC $4.00

A method for the accurate determination of the diameter of latex spheres is discussed. Monodisperse latex spheres can be used for calibration purposes because of their well-defined form and size. The size of spheres supplied does not always coincide with the manufacturer's claim. Two diameters, 0.822 and 1.011 micrometer, were checked by means of Millikan's drop chamber experiment. The differences from the claimed values were small. The absorption of water on a latex particle was determined by comparison with the drop velocity before and after drying. A row method was applied to verify the diameters. ESRO

N74-17176# Boston Coll., Chestnut Hill, Mass. Dept. of Chemistry.
DESIGN AND CONSTRUCTION OF A ONE METER VACUUM ULTRAVIOLET SPECTROMETER
Donald I. MacLean and George W. Tregay Jul. 1973 115 p refs
(Grant AF-AFOSR-1523-68; AF Proj. 9750)
(AD-770057; FRK-127; AFOSR-73-1946TR) Avail: NTIS CSCL 20/6

An off-plane Eagle mounting has been employed in the design and construction of a one meter vacuum ultraviolet spectrometer. Either film or photoelectric detection can be used from below 120 nm in the vacuum ultraviolet to 650 nm in the visible. Resolution of 0.016 nm (measured as full width at half height) has been attained in the second order. The combination of spectral range, resolution and choice of detection make the instrument applicable to many areas of research at a reasonable price. The mechanical design is simplified for ease of construction in small machine shops. Complete mechanical drawings and parts list are included. Author (GRA)

N74-17177# Human Engineering Labs., Aberdeen Proving Ground, Md.
FLIGHT INFORMATION SCALE TEST FOR HEADS-UP AND PANEL MOUNTED DISPLAYS
William B. DeBillis Oct. 1973 49 p refs
(AD-770418; HEL-TM-22-73) Avail: NTIS CSCL 01/4

Scales which were designed to provide altitude, airspeed and heading information, were combined into six candidate flight display formats for heads-up and panel mounted applications. Twelve U. S. Army aviators flew each format under static base simulation conditions. The subjects responded to the displays by providing a cyclic control stick response to various scale value changes. Response time and incorrect control motion

were used as dependent variables. Results of this experiment tend to indicate that considerable leeway in scale design is permissible without causing significant difference in pilot performance as measured by the dependent variables. The only statistically significant comparison occurred between best and worst display formats. On a moving thermometer tape display, the pilot performance was significantly lower. This difference was the result of scaling requirements rather than scale type.
Author (GRA)

N74-17178# Picatinny Arsenal, Dover, N.J.
FEASIBILITY STUDY OF AN AUTOMATIC PHOTOELECTRIC DETECTION SYSTEM FOR INSPECTION OF MAGNA-FLUXED M46 STEEL BODIES
Edward G. Kessler and Paul Kisatsky Nov. 1973 38 p refs
(AD-770508; PA-TR-4582) Avail: NTIS CSCL 14/2

The objective of the program was to automate and speed up the existing magna-glow detection by replacing the human observer with a high speed photosensor system. Fundamentally, each item is presented to the inspection device in some manner after having been routinely magna-glowed. An optical system collects the light from the item, rejects the ultraviolet components, and a photodetector recognizes the characteristic yellow phosphor adhering to the cracks and surface discontinuities. By expanding the signal to background ratio, optimizing the field of view and using pulse discriminating electronics it was possible to correlate the photocells output signal with the magnitude of the surface discontinuity. (Modified author abstract) GRA

N74-17179# GCA Corp., Bedford, Mass. Technology Div.
PROJECT CHASER: PHOTOMETER SENSOR PACKAGE Final Report, 15 Jun. 1970 - 31 Dec. 1972
Frederick F. Marmo Jan. 1973 89 p
(Contract F19628-70-C-0294; AF Proj. 8627)
(AD-770092; GCA-TR-73-1-A; AFCRL-TR-73-0338) Avail: NTIS CSCL 17/5

Rocketborne photometers were designed, tested, installed, and successfully flown in a series of field operations as part of Project CHASER, for observing missile exhaust plumes in a restricted spectral region. The equipment consisted of several alternative daytime/nighttime and photometric/imaging modes. A special baffling system was incorporated which provided high off-axis rejection of stray light for daytime baffling system. Additionally, a mechanical belt scanner was employed to derive target imaging information. The report includes discussions of the instrumentation employed as well as those source and background factors which affect the design and field operation of the system. Author (GRA)

N74-17180# Naval Ordnance Lab., White Oak, Md.
A NEW TOOL FOR ACCURATELY MEASURING THE INSIDE DIAMETER OF A GUN BARREL, LONG TUBE, OR SIMILAR
Jacob Paauwe 29 Aug. 1973 24 p
(AD-769272; NOLTR-73-174) Avail: NTIS CSCL 14/2

The report describes a newly developed tool or gage for accurately measuring the inside diameter of gun barrels or any long tube where the ratio of the inside diameter and length is large, for example, 1 in 100 or more. Author (GRA)

N74-17181# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE PHOTOGRAPHIC CHARACTERISTICS OF THE UFSH-4 USED IN THE ORION APPARATUS
V. M. Uvarova, M. R. Shpolskii, A. N. Oshurkova, Dzhuletta Oganesyan, and N. V. Uvarova 18 Oct. 1973 9 p Transl. into ENGLISH from Byurakanskaya Observatoriya. Soobshcheniya (USSR), no. 65, 1972 p 42-47
(AD-769325; FTD-HT-23-199-74) Avail: NTIS CSCL 14/5

The absolute sensitivity of UFSh-4 film in the 4400-2500 A range was determined. The influence of radiation on the sensitometric characteristics of UFSh-4 film was determined. Also tested was the photographic processing of UFSh-4 film exposed in the Orion apparatus. GRA

N74-17182# Andros, Inc., Berkeley, Calif.
NEW TECHNOLOGY REPORT
1 Nov. 1973 15 p
(Contract N00014-73-C-0185)
(AD-769133) Avail: NTIS CSCL 14/2

The report discusses work concerned with demonstrating the feasibility of using a gas density modulation technique to determine the concentration of CO2 in hyperbaric gaseous environments, in which the total pressure could range between 15 and 1200 psia. This was done by subjecting a sample of gas to a constant fractional change in volume, and measuring the fractional change in the infrared radiation transmitted through the sample. GRA

N74-17183# Honeywell, Inc., Lexington, Mass.
PRACTICAL CALIBRATION OF OPTICAL SPECTROMETERS FOR FIELD MEASUREMENTS
Jan. 1973 86 p refs Prepared in cooperation with Brower Engineering, Inc., Westboro, Mass.
(Contract DNA001-72-C-0193)
(AD-769920; DNA-3152T) Avail: NTIS CSCL 20/6

The calibration objectives of spectrometric, photometric, and radiometric instruments for field measurements are given. The instrumental optical properties which are to be ascertained are: (1) background noise levels, (2) field of view, (3) frequency response, (4) absolute spectral scan position, (5) optical resolution, (6) relative spectral response, (7) absolute responsivity, (8) spectral purity. The important technical definitions, meanings and relationships are given. The special considerations and practical limitations encountered are discussed, as appropriate, in each of four regions of the electromagnetic spectrum. These wavelength ranges of interest are categorized as UV (1800 to 4000 A), visible (4000 to 10,000 A), SWIR (1 to 5 micrometers and LWIR (5 to 25 micrometers) according to the optical detector properties and operating requirements which are distinct in each region. Author (GRA)

N74-17184# Army Foreign Science and Technology Center, Charlottesville, Va.
INTERNATIONAL SYMPOSIUM ON AEROPHOTOTRIANGULATION
L. A. Kashin and V. A. Polyakova 19 Oct. 1973 12 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 1, 1972 p 63-70
(AD-770525; FSTC-HT-23-134-73) Avail: NTIS CSCL 08/2

On the proposal of the International Photogrammetry Center, a resolution was made to analyze the results of field and experimental studies on aerophototriangulation conducted by various IPS member organizations. A discussion of more than twenty papers on this subject is included in this report. GRA

N74-17185# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE SATIN SYSTEMS: A MINICOMPUTER-BASED INFRARED TELESCOPE ACQUISITION AND TRACKING SYSTEM
Thomas P. Fitzgibbon, Donald Keene, C. Carl. Ogren, Bernard Goodman, and George Kossuth May 1973 152 p refs Prepared by MIT, Cambridge.
(Contract F19628-73-C-0002; AF Proj. 627A)
(AD-770005; ESD-TR-73-168; R-751) Avail: NTIS CSCL 17/5

The material in this report is intended to give both a general and detailed view of the Lincoln Laboratory SATIN system. The SATIN system is a computer-based acquisition and tracking system for infrared telescopes. The SATIN system represents a complex state-of-the-art system in computer control technology. The implementation of the system involves use of advanced analytical concepts for filter design as well as a structured approach to the design of a software system. The software system is a multi-level asynchronous interrupt-controlled system with software tasks arranged on hierarchical levels. (Modified author abstract) GRA

N74-17186# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGY CALIBRATION OF THE ORION SPECTOGRAPH
G. A. Gurzadyan, Dzhuletta Oganesyan, and R. A. Epremyan 17 Oct. 1973 9 p refs Transl. into ENGLISH from Byurakansk. Observ. Soobshcheniya (USSR), no. 65, 1972 p 36-41
(AD-769324; FTD-HT-23-198-74) Avail: NTIS CSCL 03/2

The Orion telescope with spectrograph, designed for obtaining

short-wave spectrograms of stars, was energy-calibrated in its working range from 2000 to 3800 A before being installed aboard the orbital station Salyut. The purpose of the calibration was to find the curve of relative spectral sensitivity of the entire optical system with the radiation receiver in the indicated wavelength range. GRA

N74-17187# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTOGRAMS OF ALPHA LYR AND BETA-CEN IN THE 2000-3800 A REGION
V. I. Patsaev, Dzhulyan Organesyan, and G. A. Gurzadyan 16 Oct. 1973 9 p refs Transl. into ENGLISH from Byurakansk. Observ. Soobscheniya (USSR), no. 65, 1972 p 36-41
(AD-769566; FTD-HT-23-196-74) Avail: NTIS CSCL 03/2

During the flight of the Salyut orbital station, six spectrograms of Beta-Cen and ten spectrograms of Alpha-Lyr were obtained in the 2000-38000 A region with a spectral resolution of about 5 A per 2600 A. Results are discussed. GRA

N74-17188# General Electric Co., Syracuse, N.Y. Electronics Lab.
DIGITIZING HOLOGRAPHIC DATA
John D. Nelligan Nov. 1973 73 p
(Contract N00024-73-C-1047)
(AD-770882) Avail: NTIS CSCL 17/1

Time Average holographic interferograms of a 5 x 5 array of AN/SQS-23 active sonar transducer element were subjected to digital processing in an effort to extract amplitudes of vibration as a function of face location. The degree of additional noise imputed to the data by the intermediate transparency together with the lack of a static interferogram for reference purposes renders the extraction of fringe loci by global double threshold techniques impracticable. Recommendations for successful extraction are presented. Author (GRA)

N74-17189# Naval Postgraduate School, Monterey, Calif.
FIBER OPTIC AND LASER DIGITAL PRESSURE TRANSDUCERS M.S. Thesis
John Wallis Leonard Jun. 1973 77 p refs
(AD-767653) Avail: NTIS CSCL 14/2

The theory and response of fiber optic pressure transducers were investigated in a continuation of previous research. A 0.125-inch diameter transducer was built and statically tested. A probe consisting of two concentric glass fiber bundles was used to transmit light to and from the transducer diaphragm. Response was linear through 60 inches Hg. Linearity and sensitivity of response were dependent on diaphragm thickness and probe location, respectively. In a separate experiment, a gas laser was externally modulated by means of a moveable mirror. Axial movement of the mirror corresponding to half-wavelengths of laser radiation produced intensity maxima and minima. This modulation concept was extended to pressure measurement by attaching the mirror to a pressure sensing diaphragm. Author (GRA)

N74-17412* Princeton Univ. Observatory, N.J.
LARGE SPACE TELESCOPE TELEVISION SENSOR DEVELOPMENT
J. L. Lowrance *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 81-92 (For availability see N74-17406 08-23)
CSCL 20F

N74-17414* California Univ., San Diego.
DIGITAL MULTICHANNEL PHOTOMETRY WITH DIGICONS
C. E. McIlwain *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 107-123 refs (For availability see N74-17406 08-23)
CSCL 14B

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-17190 Brigham Young Univ., Provo, Utah.
KINETICS OF COAL GASIFICATION IN A LOW PRESSURE, LOW RESIDENCE TIME, ENTRAINED FLOW REACTOR Ph.D. Thesis
Chiang-Liu Chen 1973 192 p
Avail: Univ. Microfilms Order No. 73-31405

Experimental studies were made with a small entrained reactor in which the finely-ground coal entrained in carrier gas was rapidly mixed with oxidizing combustion gases. A maximum of 66.5 percent coal was gasified in 0.012 seconds. The char formation was an overall zero order while the acetylene decomposition was a second order reaction with a frequency factor of 4 times 10 to the 7th power and an activation energy of about 12 Kcal/mole. The residence time of less than 0.050 seconds is sufficient for hydrocarbon gas production. Higher residence time resulted in lower gasification because of partial decomposition of hydrocarbons to elementary carbon. Dissert. Abstr.

N74-17191 Stuttgart Univ. (West Germany). Inst. fuer Umformtechnik.
PROCEDURE FOR APPROXIMATIVE CALCULATION OF EVOLUTION OF HEAT AND TEMPERATURE DISTRIBUTION DURING COLD PRESSING OF METALS [EIN VERFAHREN ZUR NAEHERUNGSWEISEN BERECHNUNG DER WAERMEENTWICKLUNG UND DER TEMPERATURVERTEILUNG BEIM KALTSTAUCHEN VON METALLEN]
Walther Pohl Essen Verlag W. Girardet Apr. 1972 131 p refs In GERMAN Sponsored by Deut. Forschungsgemeinschaft (Rept-23) Copyright. Avail: Issuing Activity

A method for the approximate calculation of heat generation and temperature distribution during cold pressing of metals is given. As a basis for calculation the v. Mises plasticity theory was used. The heat evolution and temperature distribution were treated separately in order to save computing time. The temperature fields calculated show the same trends as the heat conduction properties of the metals investigated (Al 99.5; Ck 15; and X 12CrNi 18 8). ESRO

N74-17192*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEXTURING AND RESIDUAL STRESS IN METALS AS A RESULT OF SLIDING
Donald R. Wheeler Washington Feb. 1974 17 p refs
(NASA-TN-D-7578; E-7734) Avail: NTIS HC $2.75 CSCL 11F

Pole figures of the texturing produced by friction in the alloys Cu - 10 at. % Sn, Cu - 10 at. % Si, 440 C stainless steel, and AISI 52100 bearing steel were obtained with an energy-dispersive X-ray diffractometer. While the texturing behavior of these alloys is generally similar to that of pure metals, the 52100 steel and the Cu5Si phase of Cu - 10 at. % Si show no texturing at the loads and speeds used in this experiment. Photographic methods were used in an attempt to measure the uniform residual stress in the wear tracks produced on some pure metals. The stress in copper and iron was, however, below the limit of detectability - about 4.3 x 10 to the 7th power N/sq m (6000 psi). Line broadening under all test conditions in the case of copper and at high load and speed conditions in iron is attributed, at least in part, to the reduction of crystallite size and, perhaps, to nonuniform residual stress, as well. Author

N74-17193*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF THE DYNAMICS OF A NUTATING BODY
William J. Anderson Washington Feb. 1974 23 p refs
(NASA-TM-X-7569; E-7696) Avail: NTIS HC $3.00 CSCL 20K

The equations for the displacement, velocity, and acceleration

of a point in a nutating body are developed. These are used to derive equations for the inertial moment developed by a nutating body of arbitrary shape. Calculations made for a previously designed nutating plate transmission indicate that that device is severely speed limited because of the very high magnitude inertial moment. Author

N74-17194*# Scientific Translation Service, Santa Barbara, Calif.
INVESTIGATIONS ON ELASTOHYDRODYNAMICAL LUBRICATION FILM THICKNESS FOR ELLIPTICAL HERTZ CONTACT SURFACES Ph.D. Thesis
P. Brueser Washington NASA Jan. 1974 140 p refs Transl. into ENGLISH from Universitat Carolo-Wilhelmina zu Braunschweig zur Erlangung der Wuerde eines Doktor-Ingenieurs dissertation, Braunschweig, West Germany, 144 p
(Contract NASw-2483)
(NASA-TT-F-15215) Avail: NTIS HC $10.00 CSCL 11H

A numerical method has been developed for elliptical hertz contact areas which makes it possible to calculate the phenomena in the lubrication gap. Considering the pressure dependence of the oil viscosity and oil density, the system of equations which describe the problem are solved together. Two different iteration methods provide the desired results for the inlet zone and for the hertz region proper. A test stand and a suitable measurement method have been developed for experimentally determining the lubrication film thickness. Load levels up to the elastic deformation limit can be applied. Other possible parameters include the circumferential velocity and the geometry of the rollers rolling along each other. Also the characteristics of the oil can be varied. The crack thickness is determined using capacity changes. The measured values are recalculated into distance values, using mathematical formulas. Theoretical and experimental investigations confirm the existence of an almost parallel lubrication film between the highly loaded roller bodies having elliptical contact surfaces. Author

N74-17195*# General Technologies Corp., Springfield, Va.
DEVELOPMENT OF IMPROVED ELECTROFORMING TECHNIQUE
Lee C. McCandles and Larry G. Davies 1 Nov. 1973 108 p refs
(Contract NAS3-15828)
(NASA-CR-134480; GTC-297) Avail: NTIS HC $8.50 CSCL 13H

Techniques were studied to reinforce or strengthen electroformed nickel to allow a fuller utilization of electroforming as a reliable and low cost fabrication technique for regenerately cooled thrust chambers. Techniques for wire wrapping while electrodepositing were developed that can result in a structurally strong wall with less weight than a conventional electroformed wall. Also a technique of codepositing submicron sized THO2 particles with the nickel to form a dispersion strengthened structure was evaluated. The standard nickel cylinders exhibited an average hoop strength of 80,000 psi with a yield strength of 65,000 psi and a modulus of 25.6 x 10 to the 6th power psi. The as produced dispersion strengthened nickel showed a hoop strength of 97,000 psi with a yield strength of 67,000 psi. This is an increase of 17,000 psi or 21% over the standard nickel hoop strength. The wire wrapping cylinders showed an increased strength over the standard nickel test samples of 26,000 to 66,800 psi which is in the range of 26 to 104% increase in strength over the base standard nickel. These latter test results are indicative of a volume percent wire reinforcement from 15 to 31. The measured hoop strengths agree with calculated composite strengths based upon rule of mixtures. Author

N74-17196*# Sherritt Gordon Mines, Ltd., Fort Saskatchewan (Alberta).
PROCESS DEVELOPMENT FOR Ni-Cr-ThO2 AND Ni-Cr-Al-ThO2 SHEET
R. C. Cook and L. F. Norris Dec. 1973 115 p refs
(Contract NAS3-14313)
(NASA-CR-134484) Avail: NTIS HC $8.75 CSCL 13H

A process was developed for the production of thin gauge Ni-Cr-ThO2 sheet. The process was based on the elevated temperature deposition of chromium onto a wrought Ni-2%ThO2 sheet and subsequent high temperature diffusion heat treatments to minimize chromium concentration gradients within the sheet. The mechanical properties of the alloy were found to be critically dependent on those of the Ni-2%ThO2 sheet. A similar process for the production of a Ni-Cr-Al-ThO2 alloy having improved oxidation resistance was investigated but the non-reproducible deposition of aluminum from duplex Cr/Al packs precluded successful scale-up. The mechanical properties of the Ni-Cr-Al-ThO2 alloys were generally equivalent to the best Ni-Cr-ThO2 alloy produced in the programme. Author

N74-17197# National Research Council of Canada, Ottawa (Ontario).
ELECTROSLAG CASTING OF FORGED INGOTS
L. A. Kamenskii, V. A. Kudrin, A. B. Mostovoi, V. V. Golovchenko, and L. F. Vygodner 1974 28 p Transl. into ENGLISH from Sb. Trudov Mosk. Vechernego Met. Inst. (Moscow), v. 10, 1971 p 146-162
(NRC-TT-1721) Avail: NTIS HC $4.50

The application of electroslag melting and remelting for improving the purity of steel ingots is discussed. The process removes harmful impurities and nonmetallic inclusions, and increases physical and chemical uniformity of the ingot as a result of controlled solidification. The subjects included are: (1) the optimum composition of the slag, (2) the high reactivity of the slag, and (3) the optimum heating regime for the ingots. Tables of data describing the composition of the ingots and drawings of the processing equipment are included. Author

N74-17198# Cranfield Inst. of Technology (England).
THE PEG SYSTEM OF PRODUCTION CONTROL USING A VISIBLE RECORD COMPUTER
P. E. Galgut Oct. 1973 45 p
(Cranfield-M/P-4) Avail: NTIS HC $5.25

The PEG system of production control has been designed to operate on an inexpensive computer (Philips P350 series of Visible Record Computers), so that it is suitable for small and medium sized manufacturing companies, particularly those engaged in batch production. It incorporates an adaptive loading procedure, enabling realistic delivery dates for customers' orders to be determined. Other features of the system include accurate stock recording, the preparation of works order documentation, progress control and the preparation of a Forward Load Report. Author

N74-17199# Harvard Univ., Boston, Mass. Air Cleaning Lab.
PROCEEDINGS OF THE TWELFTH AEC AIR CLEANING CONFERENCE, VOLUME 1
M. W. First, ed Jan. 1973 509 p refs Conf. held at Oak Ridge, Tenn., 28-31 Aug. 1972 Sponsored by AEC
(Conf-720823-P1) Avail: NTIS HC $21.20 (2 volumes)

Abstracts are presented for nineteen of the twenty-eight papers presented. Nine papers appeared previously. NSA

N74-17200# Saes Getters S.p.A., Milan (Italy).
A NON-EVAPORABLE GETTER FOR LOW TEMPERATURES
A. Barosi and T. A. Giorgi 1972 10 p refs
(TR-25) Avail: NTIS HC $4.00

A new high surface area low temperature getter material was developed, consisting of zirconium powder sintered at high temperatures in the presence of graphite. The porosity, surface area, and chemisorption characteristics are discussed and its practical use is described. The activation conditions and room and high temperature gettering characteristics were studied. ESRO

N74-17201# Illinois Univ., Urbana. Dept. of Civil Engineering.
EFFECTS OF POROSITY ON THE FATIGUE BEHAVIOR OF ALUMINUM ALLOY WELDMENTS Technical Report, 1 Oct. - 1 Nov. 1973
F. V. Lawrence 7 Nov. 1973 11 p ref
(Contract N00024-73-C-5344)
(AD-769886) Avail: NTIS CSCL 13/5

It appears that the characteristics of the toe of the weld controls the fatigue crack initiation and propagation phenomena in the as welded specimens; and the size, and distribution and possibly location of the largest pore(s) control the fatigue crack

initiation and propagation phenomena in weld reinforcement removed specimens. GRA

N74-17202# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIFIC WELDING PROCEDURES: THE CHARACTERISTICS OF THE ELECTRON BEAM WELDING AND CUTTING PROCEDURE UNDER COSMIC CONDITIONS
B. E. Paton, O. K. Nazarenko, V. I. Csalov, J. V. Neporozsnij, and V. K. Lebedev 29 Oct. 1973 22 p Transl. into ENGLISH from Finommechanika (Hungary), Feb. 1972 p 33-38
(AD-770431; FTD-HC-23-260-74) Avail: NTIS CSCL 13/8

The report analyzes fundamental principles which can serve as a basis for an electron beam installation which complies with high demands, can be handled with ease under the specific conditions of cosmic space, has small dimensions and low weight, does not involve any safety hazards for the astronaut, is not complex, and is suitable for the welding and cutting of thin steel plates. GRA

N74-17203# Westinghouse Astronuclear Lab., Pittsburgh, Pa. Astronuclear Lab.
A LOAD CALIBRATION TECHNIQUE FOR USE ON LARGE INDUSTRIAL PRESSES AND SMALL TESTING MACHINES Interim Technical Report, 1 Jan. 1971 - 1 Feb. 1973
V. DePierre, S. O. Davis, and F. J. Gurney Jun. 1973 31 p refs
(Contract F33615-71-C-1163; AF Proj. 7351)
(AD-769265; AFML-TR-73-102) Avail: NTIS CSCL 13/9

A load calibration technique based on the plastic deformation of a ring specimen is described. The method is applicable to any size press at loads up to full capacity. The method consists of determining the true flow stress of a heat of material by compression of small ring specimens on a calibrated test machine and treating the geometric change of the ring mathematically. Larger rings from the same heat of material are then deformed in large industrial presses or smaller testing machines which are to be calibrated. The geometric changes in the ring specimen and the previously determined flow stress are treated by the same mathematical analysis to determine the deformation pressure and thus the deformation load. A comparison is made of the calibration from the ring cell with other calibrations already determined on a mechanical crank press and a hydraulic extrusion press. The ring cell is shown to yield highly accurate loads. Author (GRA)

N74-17204# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FABRICATION PROCEDURE FOR SILICON MEMBRANE X-RAY LITHOGRAPHY MASKS
Ronald A. Cohen, Robert W. Mountain, Henry I. Smith, Muriel A. Lemma, and David L. Spears 20 Sep. 1973 15 p refs
(Contract F19628-73-C-0002; DA Proj. 7X2-63304-D-215)
(AD-769857; TN-1973-38; ESD-TR-73-248) Avail: NTIS CSCL 20/2

A step-by-step procedure for the fabrication of silicon membrane X-ray lithography masks is described. The procedure involves the diffusion of boron into the polished face of an n-type -100= silicon wafer, the formation of gold absorber patterns on the boron diffused face, and the selective etching of the n-type silicon so as to produce thin membranes (2 to 5 microns thick) of silicon supporting the absorber patterns. Author (GRA)

N74-17205# Army Tank-Automotive Command, Warren, Mich.
CASTING TECHNOLOGY RELEVANT TO THE PRODUCTION OF HIGH STRENGTH ALUMINUM SAND CASTINGS
Alan G. Fleming and G. B. Singh Nov. 1973 29 p refs
(AD-770501; TACOM-TR-11727) Avail: NTIS CSCL 13/8

High-strength aluminum sand casting alloys such as type 201 and 224 offer yield strengths upwards of 55,000 psi on bars cut from castings. The range of properties represented expands the technical base and design strength range of aluminum castings; their utilization will result in longer service life as a consequence of improved heat rejection capability and lowered running temperatures under high ambient temperature operation. Significant weight savings realized in individual applications should enhance vehicle mobility characteristics. Author (GRA)

N74-17206# Stanford Univ., Calif. Dept. of Operations Research.
OPTIMAL ALLOCATIONS IN THE CONSTRUCTION OF K-OUT-OF-N RELIABILITY SYSTEMS
C. Derman, G. J. Lieberman, and S. M. Ross 17 Sep. 1973 25 p refs
(Contracts N00014-67-A-0112-0052; DA-31-124-ARO(D)-331; N00014-67-A-0108-008; N00014-69-A-0200-1036; NR Proj. 042-002)
(AD-770049; SU-TR-73-17; TR-155; TR-58) Avail: NTIS CSCL 14/4

The authors want to build n components so as to form an n component system which will function if at least k of the components function if x dollars is invested in building a component then this component will function with probability P(x), where P(x) is an increasing function such that P(0) = 0. The problem of interest is to determine how much money should be invested in each component so as to maximize the probability of attaining a functioning system. The authors are interested in this problem both in the sequential and in the nonsequential case. Section 2 considers the case k = 1. Conditions are presented on P(x) under which (a) it is optimal to put an equal investment in all n components and (b) it is optimal to put the total fortune A into a single component. In Section 3, it is shown that the equal investment condition carries over to the case of general k. In Section 4 the special case P(x) = x in the sequential situation is considered and the optimal policy is determined when k = 2. A conjecture as to the optimal policy in the general case is also made. Several remarks are made concerning the non-sequential case with P(x) = x in Section 5. In the final section a related problem is considered.(Modified author abstract) (GRA)

N74-17207# Army Foreign Science and Technology Center, Charlottesville, Va.
HIGH-PRESSURE WORKING OF MATERIALS
L. Vereshchagin 18 Oct. 1973 17 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 4, 1972 p 2-11
(AD-770512; FSTC-HT-23-100-73) Avail: NTIS CSCL 13/8

A discussion on the development of the process of hydrostatic extrusion and hydroextrusion machinery is presented. Also included in the report is a description of the direct application of high uniform pressure for the technological process of metal working and the effects of pressure on the mechanical properties of materials. Author (GRA)

N74-17208# Southwest Research Inst., San Antonio, Tex.
HYDRAULIC GRIP SYSTEM FOR COMPOSITE TUBE SPECIMENS Technical Report, Apr. 1972 - 1 Aug. 1973
A. Nagy and U. S. Lindholm Sep. 1973 35 p refs
(Contract F33615-72-C-1703; AF Proj. 7340)
(AD-770447; AFML-TR-73-239) Avail: NTIS CSCL 13/5

The report describes the development of a hydraulic grip system for use in the mechanical testing of composite tubular specimens under biaxial loads. The objective of the grip system is to eliminate the constraints imposed by rigidly bonded end tabs which generally lead to premature failure in strength tests. The new hydraulic grip uses a uniform clamping pressure to transfer axial and torsional loads to the specimen and an active, servo-controlled, differential clamping pressure to produce radial displacement in the grip which compensates for changes in diameter of the specimen gage section during loading. This active control feature minimizes the bending stresses at the specimen-grip interface. Preliminary tests with the grip demonstrate its load transfer capability and the active compensation feature. Author (GRA)

N74-17209# Watervliet Arsenal, N.Y.
A PHENOMENOLOGICAL DESCRIPTION OF CENTRAL BURST FORMATION DURING HYDROSTATIC EXTRUSION
Joseph Pepe May 1973 46 p refs
(DA Proj. 1T0-62105-A-328)
(AD-763201; R-WV-T-6-16-73) Avail: NTIS CSCL 13/8

A detailed metallographic investigation of the phenomenological development of central burst defects during hydrostatic extrusion was conducted. The characteristic extrusion pressure versus billet-displacement curve of extrusion containing center

burst defects was periodic; each periodic segment consisted of a constant pressure part during which the extrusion velocity was slow followed by a decreasing pressure part during which the extrusion velocity was rapid. It was established that during the part of the cycle exhibiting slow billet movement, near the billet centerline beyond the end of the die deformation zone, small microcracks formed, linked-up by tensile fracture and formed a rather large cone shaped defect exhibiting little crack opening displacement. (Modified author abstract) Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N74-17210 Louisiana State Univ., Baton Rouge. Agricultural and Mechanical Coll.
DECOMPOSITION OF CRYPTOCYANINE Q-SWITCHES FOR HIGHER PEAK POWER RUBY LASERS Ph.D. Thesis
Roberta Anne Hollier 1973 142 p
Avail: Univ. Microfilms Order No. 73-27842

The phenomenology of the decomposition of cryptocyanine molecules in liquid solutions placed in the optical cavity of a high peak power ruby laser is reported along with techniques by means of which such solutions can be stabilized. Possible mechanisms for irreversible bleaching of methanolic cryptocyanine solutions are presented. Investigative techniques are given which may serve as a point of departure for further research on other dye systems of considerable technological and theoretical interest. It was determined that ultraviolet radiation, in a band of wavelengths near 300 nm, produced by the flash lamps used to pump the rod, is responsible for nearly all of the photochemical decomposition of cryptocyanine in methanolic solutions used as passive shutters (Q-switches) in high peak power ruby lasers. Dissert. Abstr.

N74-17211 Louisiana State Univ., Baton Rouge. Agricultural and Mechanical Coll.
A FEASIBILITY STUDY OF OZONE REMOTE SENSING BY LASER INDUCED INFRARED FLUORESCENCE Ph.D. Thesis
John Louis Guagliardo 1973 178 p
Avail: Univ. Microfilms Order No. 73-27838

The objective of this work was to study the fluorescence of ozone induced by its exposure to a carbon dioxide laser. The work was divided into three parts: (1) the construction and testing of a continuous, tunable carbon dioxide laser (2) a study of the analytical parameters involved in developing a precedure for the remote sensing of ozone based on laser induced infrared fluorescence; and (3) a short attempt at actual remote sensing. A carbon dioxide laser was built which was tunable over the range of 9.2 to 10.8 microns. This laser was found to be much more stable than commercial nontunable lasers, but was not quite as powerful. Fluorescence was observed for concentration of about one per cent ozone from a 0.6 milliliter volume. Absolute analytical sensitivity then was found to be seventy micrograms of ozone. Dissert. Abstr.

N74-17212*# Radio Corp. of America, Burlington, Mass. Aerospace Systems Div.
LASER RANGE POLE FIELD EVALUATION REPORT
Dec. 1973 14 p Sponsored in part by US Forest Service
(Contract NA65-23092)
(NASA-CR-132927) Avail: NTIS HC $4.00 CSCL 20E

A field evaluation was made of the laser pole equipment. The basic plan for the evaluation was to expose the equipment to the actual people and environment for which it was intended and determine, through the use of the equipment, its resultant effectivity in terms of improved performance. Results show the equipment performed better than expected in the high elevation clean air of Colorado, and did as well in Tennessee. Author

N74-17213# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
SINGLY IONIZED CARBON LASER AT 6783, 6578 AND 5145 A
A. B. Petersen and M. Birnbaum 8 Feb. 1974 8 p refs
(ATR-74(9430-01)-2) Avail: NTIS HC $4.00

Three new laser transitions of singly ionized carbon atoms were observed in pulsed discharges of CO, CO2 and C6H6. Laser output was observed at 6578.0, 5145.7, and 6783.6 A of the C2 spectrum. Author

N74-17214*# Techtran Corp., Glen Burnie, Md.
THE PATHOGENIC ACTION OF QUANTUM GENERATORS (LASERS)
V. V. Shikhodyrev, P. D. Gorizontov, ed., and N. N. Sirotinin, ed. Washington NASA Feb. 1974 20 p refs Transl. into ENGLISH from the book "Patologicheskaya Fiziologia Extremalnykh Sostoyanie" Moscow, Meditsina Press, 1973 p 370-380
(Contract NASw-2485)
(NASA-TT-F-15326) Avail: NTIS HC $4.00 CSCL 20E

Effects of intense light on the human organism is addressed in relation to the specific source, in this case optical quantum generators (OQG), better known as lasers. The bases of laser effects on the organism are presented. Reaction mechanisms and protective measures conclude the article. Author

N74-17215# GTE Labs., Inc., Waltham, Mass.
GAS LASERS Final Report, 1 Feb. 1972 - 1 Jun. 1973
R. Pappalardo 15 Nov. 1973 88 p refs
(Contract N00014-71-C-0164; NR Proj. 016-304)
(AD-770174; TR-73-841.1) Avail: NTIS CSCL 20/5

Emission from metal-halide vapors under pulsed-discharge excitation has been studied in a search for new laser systems. Only minor cavity-feedback effects have been observed in the case of cuprous bromide, while these effects were more pronounced for mercuric bromide. Attempts to produce single-pass super-radiant emission from laser-pumped vapors of organic molecules were unsuccessful. A new diagnostic technique to monitor gain-loss effects in pulsed discharges is described. Afterglow character and high-gain are reported for the O(III) laser transitions. Two new laser lines of O(III) have been observed in the UV. Author (GRA)

N74-17216# Sandia Labs., Albuquerque, N.Mex.
LASER Q-SWITCHED BY A PLZT SHUTTER
M. J. Landry Sep. 1973 25 p refs
(Contract AT(29-1)-789)
(SLA-73-709) Avail: NTIS HC $3.25

The application of a polycrystalline ferroelectric ceramic Pb1-xLax(ZryTiz)1-x/4O3 (called PLZT) electro-optic shutter is described for controlling the giant pulse emission of ruby laser. The PLZT material had y = 65% and z = 35%, and the value of x was in the vicinity of 8%. Half wave retardation switching was not available for the PLZT shutter when 10-nsec risetime, 70-nsec-duration voltage pulses (fast Q-switching) were applied. The increased insertion loss, due to less than half wave retardation, resulted in laser pulse widths about one order of magnitude wider than predicted by fast Q-switching theory which used the minimum insertion loss available for half wave retardation switching. The observed output power also was one order of magnitude less than predicted. Since the PLZT damaged at relatively low energy and power densities of 0.17 to 0.56 J/cm sq and 5.6 to 8.5 MW/cm sq respectively, it can be used only as a laser Q-switch at small output power. Author (NSA)

N74-17217# Los Alamos Scientific Lab., N.Mex.
CO2 GAS LASER STUDIES
C. B. Mills Sep. 1973 46 p ref
(Contract W-7405-eng-36)
(LA-5151-MS-Suppl-2) Avail: NTIS HC $4.00

The numerical solution of the current continuity equations for electrons in dense plasma, and the solution of the equations for laser gain in a gaseous plasma are shown in detail. Author (NSA)

N74-17218# California Univ., Livermore. Lawrence Livermore Lab.
SIMPLE APPROACH TO LASER AMPLIFIERS
J. B. Trenholme and K. R. Manes 28 Nov. 1972 23 p refs
(Contract W-7405-eng-48)
(UCRL-51413) Avail: NTIS HC $4.00

A mathematical description of a laser amplifier is presented in a simplified way. The gain is described by rate equations. Neither diffraction nor cross-relaxation is considered. The transfer properties of the amplifier are analyzed, and its effects on the spatial and temporal pulse shape are described. It is shown why operation at more than 5 or 10 times the saturation flux is undesirable unless the resulting pulse distortion can be accepted. This report is a consolidation and review of known results, and a study of their implications for laser amplifier design. Author (NSA)

N74-17219# California Univ., Livermore. Lawrence Livermore Lab.
LASNEX SIMULATION OF X-RAY GENERATION
H. D. Shay 24 Jul. 1973 23 p refs Presented at DNA Conf., Washington, D. C., 8-9 Feb. 1973
(Contract W-7405-eng-48)
(UCID-16297; Conf-730221-1) Avail: NTIS HC $3.25

The X-ray data of two laser-plasma experiments conducted by Mallozzi, et al. and Mead and Violet are examined in light of numerical simulations performed with the code LASNEX. Author (NSA)

N74-17220# Impulsphysik G.m.b.H., Hamburg (West Germany).
LIDAR TECHNIQUE AND VISUAL RANGE MEASUREMENT. REVIEW OF STATE-OF-THE-ART [LIDAR TECHNIK UND SICHTWEITENMESSUNG. UEBERSICHT UEBER DEN DERZEITIGEN STAND DER TECHNIK]
F. Fruengel [1972] 25 p refs In GERMAN
Avail: NTIS HC $4.25

A number of different optical range measuring methods is surveyed, and typical measurement errors are discussed. The role of the optical transmission qualities, forward and backward scattering, is considered, the fundamental problem being the size of drops in the atmosphere. In evaluating the different drop sizes, the application of xenon gas discharges is proposed for producing white light. Configurations for xenon lamps and receivers are reviewed. Principles of ultraviolet equipment for cloud height measurement, as well as visual and fluorescence measurement in water, are described. The equipment for lidar technology and its operation is discussed. ESRO

N74-17221# Army Foreign Science and Technology Center, Charlottesville, Va.
MODULATION OF THE RADIATION OF A HELIUM-NEON LASER USING LITHIUM NIOBATE CRYSTALS
V. A. Dyanova 19 Oct. 1973 7 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 1, 1972 p 32-36
(AD-770511; FSTC-HT-23-133-73) Avail: NTIS CSCL 20/5

Studies of ADP and KDP-type crystals for the modulation of light at various frequencies have been conducted in the Soviet Union for a number of years. Experiments with new electrooptical materials, which have certain advantages over ADP and KDP crystals, are discussed. Author (GRA)

N74-17222# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
ABSORPTION SATURATION EFFECTS ON HIGH-POWER CO2 LASER BEAM TRANSMISSION Research Report, Jul . - Nov. 1972
David C. Pridmore-Brown 13 Nov. 1973 21 p refs
(Contract F04701-73-C-0074)
(AD-770064; TR-0074(9260-09)-4; SAMSO-TR-73-350) Avail: NTIS CSCL 20/6

A theoretical and numerical investigation is made of the effect on a beam of 10.6 micrometers radiation of absorption saturation of the CO2 molecules in its path. Saturation of the CO2 absorption cross section sets in under irradiation at high power levels when induced emission balances the resonant absorption. It is shown by means of computer plots that soon after a high-power beam with a parabolic profile is turned on, a caustic may form near its boundary as a result of CO2 absorption saturation in the central portion. At high altitudes absorption saturation can lead to enhanced transmission over long distances. (Modified author abstract) GRA

N74-17223# Texas Univ., Dallas.
INVESTIGATION OF THE FEASIBILITY OF THE ELECTRON BEAM-EXCITED, HIGH PRESSURE RECOMBINATION LASER Semiannual Technical Report, 1 Apr. - 1 Sep. 1973
Carl B. Collins, Austn J. Cunningham, and Brian W. Johnson 21 Oct. 1973 119 p refs
(Contract N00014-67-A-0310-0007; ARPA Order 1807)
(AD-769833; UTDP-A002-3; SATR-3) Avail: NTIS CSCL 20/5

The report describes research applied toward the determination of the feasibility of developing a recombining, electron beam-excited plasma into a pulsed laser of exceptionally high peak power. Author (GRA)

N74-17224# Eastman Kodak Co., Rochester, N.Y. Kodak Apparatus Div.
INFRARED DYE LASER STUDY Final Report, Apr. - Sep. 1973
Sep. 1973 54 p refs
(Contract DAAK02-73-C-0185; DA Proj. 1S6-63719-D-70K)
(AD-769939) Avail: NTIS CSCL 20/5

The feasibility of a flash lamp pumped, near infrared dye laser operating at a moderate repetition rate was shown. The laser produced output pulses of 17 kw peak power at a rate of 4 pulses per minute. The flow system that is essential for multiflash operation was capable of flow rates up to 50 cc/second without degrading the output pulses; this flow rate would be adequate for operation at 10 flashes per second. The excitation source for this laser is a 20 torr N2 flash lamp with a 15 cm arc length and 3mm bore. It is powered by a 0.3 microfarad capacitor at an input energy of 86 joules. The laser produced in this project would be useful in applications requiring a few milliwatts of average power. GRA

N74-17225# United Aircraft Corp., East Hartford, Conn. Research Labs.
INFLUENCE OF DEAD ZONES AND TRANSONIC SLEWING ON THERMAL BLOOMING Midterm Technical Report, 1 Jun. - 15 Sep. 1973
Robert T. Brown, Paul J. Berger, Frederick G. Gebhardt, and David C. Smith 12 Nov. 1973 32 p refs
(Contract N00014-73-C-0454; ARPA Order 2439)
(AD-769945; UARL-M921724-4) Avail: NTIS CSCL 20/5

An experimental research program is being carried out to investigate two particular aspects of the thermal blooming problem. Thermal blooming is the self-induced effect which results from refractive index variations in the path of a laser beam caused by absorption of laser beam energy. The two aspects being investigated are the effect of transonic flow and also dead zones on the thermal distortion. When heat is added to flow at near sonic velocities severe density gradients and even shock waves can result. An experiment involving a CO2 laser and a blow down wind tunnel are being used to investigate this problem and a pulsed schlieren system is used to observe the density gradients. (Modified author abstract) GRA

N74-17226# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
IR WINDOW STUDIES Quarterly Technical Report No. 4
Ferdinand Kroger and John H. Marburger 15 Jun. 1973 67 p refs
(Contract F19628-72-C-0275; ARPA Order 2055)
(AD-770009; USCEE-457; QTR-4) Avail: NTIS CSCL 20/5

Continuing wavelength dependent absorption measurements of high purity GaAs grown from the melt by a variety of techniques show remarkably similar structure in all samples. Preliminary measurements of the dielectric constant of GaAs have been obtained. A systematic study of diffuse intensity streaks in the electron diffraction pattern of GaAs single crystals indicates that they are of thermal origin, and do not arise from inclusions or impurities. The absorption coefficient of a good quality sample of GaAs has been reduced to that of best quality samples by annelaing. Experiments on self diffusion of Cd and Te, and high temperature Hall effect in Cd Te and In-doped CdTe have been completed. (Modified author abstract) GRA

N74-17227# General Dynamics/Electronics, San Diego, Calif.
MICROWAVE HOLOGRAPHY FOR ANALYSIS OF DIFFRAC-

TION Final Report, Jul. 1972 - Aug. 1973
R. A. Hayward, E. L. Rope, and G. Tricoles Sep. 1973 82 p refs
(Contract N00019-72-C-0416)
(AD-770211; R72-026-4) Avail: NTIS CSCL 09/5

A method is described for determining the field distribution near a transmitting antenna. The method involves measurements over a spherical surface and computationally reconstructs the nearfields. The method is holographic because the complex conjugates of the measured field components are used. The method applies to planar or conformal arrays. Experimental results are given. Reconstructed nearfields are compared with measured values, and farfield patterns computed from the reconstructed nearfields are compared with measured patterns for several excitations of four element arrays. Author (GRA)

N74-17228# Calspan Corp., Buffalo, N.Y.
OH/OD CW CHEMICAL LASER STUDIES AND NEW SUPERSONIC FLOW LASER GEOMETRIES. PART 1: OH CHEMICAL LASER STUDIES Final Technical Report, 1 Jul. 1972 - 30 Sep. 1973
J. W. Raymonda and J. W. Daiber 30 Sep. 1973 80 p refs
(Contract N00014-72-C-0460)
(AD-769881; CALSPAN-WG-5179-A-2-Pt-1) Avail: NTIS CSCL 20/5

The objective of this program was to develop a continuous wave chemical laser using OH or OD as the lasing species. Chemi-excited OH(OD) was produced by reaction of hydrogen (deuterium) atoms with ozone (O3). Sidelight spectroscopy was employed to verify the presence of chemi-excited OH and to estimate the concentrations of OH in various excited vibrational states. The existence of a partial inversion on the vibration-rotation levels of OH in its electronic ground state was established. The results were rationalized in terms of a simple kinetic model in which the hydrogen atoms are the limiting reagent. Using the data obtained in this program, the improvements in technology required to achieve lasing from OD in a device of pratical size have been identified, and specific recommendations for obtaining these improvements have been put forward. Author (GRA)

N74-17229# Ohio State Univ., Columbus. ElectroScience Lab.
INVESTIGATION OF LASER PROPAGATION PHENOMENA Quarterly Report, 1 Apr. - 30 Jun. 1973
S. A. Collins, Jr. Sep. 1973 25 p refs
(Contract F30602-72-C-0305; ARPA Order 1279)
(AD-769860; ESL-3432-6; RADC-TR-73-321; QR-4) Avail: NTIS CSCL 20/6

The report presents a study of problems associated with using the Fourier transform restoration procedure to restore atmospherically degraded images of high flying objects. The study is divided into two parts, an examination of the restoration procedure and an estimate of atmospheric effects. The two parts were joined by choosing a model which assumes the phase front of an atmospherically degraded light wave can be represented as a truncated polynomial series. Preliminary results indicate that a point source on the bottom of an airplane is very nearly equivalent to a collimated source at the same location as far as ability to restore the degraded image of a much higher object. Author (GRA)

N74-17230# Naval Research Lab., Washington, D.C.
PASSIVELY MODE-LOCKED Nd-YAG OSCILLATOR STABILITY STUDY Final Report
Jules P. Letellier Nov. 1973 15 p ref
(ARPA Order 2062; NRL Proj. 65K03-08A)
(AD-770118; NRL-MR-2684) Avail: NTIS CSCL 20/5

The stability of the NRL mode-locked Nd-YAG system has been measured and experimentally optimized for long term operation. It was found that the most important parameter was the stability of the dye absorption coefficient. It was also found that it is necessary to increase dye concentration for reliable operation at longer pulse lengths. Author (GRA)

N74-17231# Northrop Corp., Hawthorne, Calif. Research and Technology Center.
SCALING GENERALIZATIONS FOR A PULSED CO EDL (ELECTRIC DISCHARGE LASER)
W. B. Lacina Oct. 1973 50 p refs
(Contract N00014-72-C-0043; ARPA Order 1806)
(AD-770074; NRTC-73-43R) Avail: NTIS CSCL 20/5

Several scaling generalizations for a pulsed CO EDL are presented and discussed. Quantum efficiency is shown to be mainly dependent upon total energy deposition as a function of time. Typically, turn-on occurs after approximately J/liter/torr has been deposited, and steady state after approximately 2 J/liter/torr. Scaled saturation intensity is approximately 0.6 - 6.0 W/sq cm/torr squared. GRA

N74-17232# Cornell Univ., Ithaca, N.Y. School of Applied and Engineering Physics.
VIBRATIONAL ENERGY TRANSFER AND CONTINUOUS-WAVE CHEMICAL LASER OPERATION. THE KINETICS AND SPECTROSCOPY OF CHEMICAL LASERS Final Scientific Report, 1 Jul. 1970 - 30 Jun. 1973
Terrill A. Cool 30 Jun. 1973 31 p refs
(Grant AF-AFOSR-1952-70; AF Proj. 9538)
(AD-770506; AFOSR-73-1981TR) Avail: NTIS CSCL 07/4

The report summarizes a research program on chemical lasers. Parametric studies of the HF, DF, HF-CO2, and DF-CO2 purely chemical lasers were accomplished with a prototype system to provide design data for CO2 lasers of multikilowatt size. The second phase of the grant resulted in accurate determinations of vibrational matrix elements and the dipole moment function for HF and DF molecules. Vibrational matrix elements were measured through the fifth overtone for both molecules. Additional investigations were launched at the end of the grant period directed toward the discovery of new chemical laser systems capable of operation at visible wavelengths. (Modified author abstract) GRA

N74-17233# Washington Univ., Seattle. Aerospace Research Lab.
NONDESTRUCTIVE DETERMINATION OF SURFACE FLAW GEOMETRY BY ACOUSTICAL HOLOGRAPHY, EXPLORATORY DEVELOPMENT Final Report, 3 Jan. 1972 - 2 Jan. 1973
M. E. Fourney, D. C. Auth, M. J. Intlekofer, and A. S. Kobayashi Jun. 1973 37 p refs
(Contract F33615-72-C-1204; AF Proj. 7351)
(AD-770108; AFML-TR-73-129) Avail: NTIS CSCL 14/2

The results of experiments aimed at developing a new nondestructive method of investigating surface flaw geometry based on acoustical holography and a newly proposed liquid crystal read-out device are presented. The liquid crystal area detector was shown to be feasible for use with acoustical holography; however, it was not applied to the monitoring of surface flaw geometry. The method was shown to have an order of magnitude improvement in resolution capabilities; however, it was found to be severely lacking in the area of sensitivity, response time, and dynamic range. A strict thermal activation of the liquid crystals by the ultrasound was found not to be the optimum. Author (GRA)

N74-17234# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 12, APRIL - JUNE 1973
Stuart G. Hibben 24 Sep. 1973 141 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-4)
(AD-770641; AFOSR-73-2071TR) Avail: NTIS CSCL 20/5

The report is the Soviet Laser Bibliography for the second quarter of 1973 and is No. 12 in the series on Soviet laser developments. The coverage includes basic research on solid state, liquid and gas lasers; chemical lasers; ultraviolet lasers; components; nonlinear optics, spectroscopy of laser materials; pulse generation; crystal growing; and general theory. Laser applications are listed under biological effects; communications; computer technology; holography; instrumentation and measurements; materials processing; and plasma generation and diagnostics. Author (GRA)

N74-17235# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTICS RESEARCH, 1973, 1 Semiannual Report, 1 Jan. - 30 Jun. 1973
Robert H. Rediker 31 Oct. 1973 82 p refs
(Contract F19628-73-C-0002; ARPA Order 600)
(AD-770629; ESD-TR-73-231) Avail: NTIS CSCL 20/5

The report covers work of the Optics Division at Lincoln Laboratory for the period 1 January through 30 June 1973. The topics covered are laser technology and propagation and optical measurements and instrumentation. (Modified author abstract) GRA

N74-17236# Michigan Univ., Ann Arbor. Dept. of Chemistry.
RESONANCE SPECTRA OF MOLECULES RELATED TO LASER MATERIALS Final Report
Thomas M. Dunn Nov. 1973 10 p refs
(Grant AF-AFOSR-1715-69; AF Proj. 9536)
(AD-770753; AFOSR-73-2068TR) Avail: NTIS CSCL 07/4

The excited state spectra of uranyl ion in glass, Ho3- ion in single crystal CaWo4 and Cr (acac) 3 in an organic glass (EPA) have been observed and characterized in terms of lifetimes and adsorption regions. A new transition has also been observed in the spectrum of the Cr3- ion in corundum crystal (ruby). Author (GRA)

N74-17237# Northrop Corp., Hawthorne, Calif.
UV GAS LASER STUDIES Semiannual Technical Report
M. L. Bhaumik and E. R. Ault Nov. 1973 43 p refs
(Contract N00014-72-C-0456; ARPA Order 1807)
(AD-770817; NRTC-73-50R) Avail: NTIS CSCL 20/5

Temporal norrowing of the optical pulse in an E-beam excited high pressure xenon laser substantiates the evidence of laser oscillations in molecular xeon reported earlier. Using a hole coupled output mirror, an energy of 0.1 J was measured in a calorimeter. This corresponds to a peak power of 10 mW demonstrating that a high power laser in the vacuum ultraviolet has been achieved. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-17238*# Case Western Reserve Univ., Cleveland, Ohio.
HYDROGEN GAS EMBRITTLEMENT AND THE DISC PRESSURE TEST Final Report, Sep. 1971 - Nov. 1973
E. J. Bachelet and A. R. Troiano 30 Nov. 1973 76 p refs
(Grant NGR-36-027-040)
(NASA-CR-134551) Avail: NTIS HC $7.00 CSCL 11F

A disc pressure test has been used to study the influenced of a hydrogen gas environment on the mechanical properties of three high strength superalloys, Inconel 718, L-605 and A-286, in static and dynamic conditions. The influence of the hydrogen pressure, loading rate, temperature, mechanical and thermal fatigue has investigated. The permeation characteristics of Inconel 718 have been determined in collaboration with the French AEC. The results complemented by a fractographic study are consistent either with a stress-sorption or with an internal embrittlement type of mechanism. Author

N74-17239# Bureau of Mines, Minneapolis, Minn. Twin Cities Metallurgy Research Center.
INFLUENCE OF MANGANESE ADDITIONS UPON PROPERTIES OF IRON ORE PELLETS
R. B. Schluter and B. W. Carriere 1974 21 p refs
(BM-RI-7870) Avail: NTIS HC $4.25

The effects of adding manganese compounds and ores to iron ore pellets are investigated. Manganese doxide, carbonate, sulfate, and chloride, plus six manganiferous ores from the Minnesota Cuyuna Range were tested and additives to increase the manganese content of iron ore pellets. One to 5 percent manganese, as a compound or ore, was added to five magnetic concentrates and one hematite concentrate. These concentrates were balled, indurated (1,300 C), and tested for reducibility. Manganese sulfate and chloride were unsatisfactory additives causing cracking and degradation of the pellets during reduction. Manganese dioxide, carbonate, and the ores were satisfactory additives. The additive increased pellet compression strengths with a corresponding loss of reducibility, as compared to the pellets without manganese additions. The changes in compression strengths and reducibility were caused by the formation of jacobsite spinel and slag within the pellets. However, when the induration temperature was lowered from 1,300 to 1,200 C the reducibility and compression strengths were comparable to the pellets without manganese additions indurated at 1,300 C. Author

N74-17240*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE STRESS CORROSION SUSCEPTIBILITY OF SEVERAL ALLOYS IN HYDRAZINE FUELS
William P. Gilbreath and Michael J. Adamson Washington Feb. 1974 21 p refs
(NASA-TN-D-7604; A-5225) Avail: NTIS CSCL 11D

The stress corrosion susceptibility of five alloys exposed to hydrazine and other related fuel environments is discussed on the basis of results from tests of crack growth in wedge opening loaded fracture specimens. It is shown that the alloys tested can be classified in order of decreasing susceptibility as follows: 4130 steel, 410 stainless steel, Inconel 718, Ti-6A1-4V (STA) and 6061-T6 A1; where the 4130 alloy shows a threshold stress intensity for flaw growth in hydrazine equal to about 20 percent of its fracture toughness and the aluminum alloy shows nonsusceptibility. The specific fuels tested, listed in order of decreasing propensity to premote stress corrosion stress corrosion cracking, are: hydrazine, Aerozine 50, monomethylhydrazine, and unsymmetrical dimethylhydrazine. Variation of a number of test parameters (load, load history, and impurity level) is shown to affect primarily the length of the incubation period before cracking initiates. Author

N74-17241# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
APPLICATION OF THE ION ANALYZER TO STUDIES OF HETERODIFFUSION IN METALS
M. Beyeler, J. L. Seran, B. Blanchard, A. Pichard, and M. Cligny 1973 33 p refs In FRENCH Presented at Meeting of the Natl. Tech. Res. Assoc. Group No. 8B Ion Analyzer, Corbeville, France, 16 Mar. 1973
(CEA-CONF-2304; Conf-730344-1) Avail: AEC Depository Libraries HC $3.75

The diffusion of metallic impurities in monocrystalline matrices of copper and aluminum irradiated with fast neutrons and ions was studied. Since the effects can extend over distances of several thousand angstroms, the ion analyzer technique was used. The experiments were carried out using diffusion couples prepared by evaporation or implantation at various temperatures and pressures. A comparison between these results and those provided by classical techniques indicates the possiblity of using the ion analyzer to study defects. NSA

N74-17242# Danish Atomic Energy Commission, Risoe. Research Establishment.
EFFICIENCY OF VOID FORMATION DURING ANNEALING OF IRRADIATED MOLYBDENUM
J. H. Evans Aug. 1973 10 p refs
(RISO-M-1641) Avail: AEC Depository Libraries HC $3.00

Results are presented to demonstrate the high efficiency of vacancy retention that occurs when voids are formed by the annealing at 900 C of molybdenum samples previously neutron irradiated at 60 C. In the particular case examined the efficiency is shown to be more than the theoretical maximum expected during the formation of voids under conventional high temperature neutron irradiation. Various aspects of this efficiency are discussed with particular reference to a recent positron annihilation study of the processes taking place during annealing. A mechanism for the high vacancy retention is suggested that depends largely on the storage of vacancies in loop form during irradiation below the temperature of vacancy loop shrinkage and the transfer of vacancies to voids on annealing above this temperature. There seems to be only a small possibility that the mechanism could operate unintentionally in reactor situations. On the other hand by ensuring void nucleation the high efficiency of void production by the irradiation-annealing method might be used to advantage in providing inexpensive void samples for experimental purposes. NSA

N74-17243# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
STRAIN RATE SENSITIVITY OF TITANIUM
A. M. Garde and R. E. Reed-Hill 1973 19 p refs
(Contract AT(40-1)-3262)
(ORO-3262-29) Avail: NTIS HC $3.00

Aspects of deformation of Ti were studied. It was found that the thermally activated rate controlling deformation mechanism in titanium at low temperatures involves overcoming of the interstitial barriers. Titanium obeys Cottrell-Stokes law when deformation occurs by slip and twinning. A minimum in the strain rate sensitivity-temperature diagram is not a sensitive parameter to measure the extent of dynamic strain aging in a metal. Author (NSA)

N74-17244# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
CREEP PROPERTIES OF A TYPE 308 STAINLESS STEEL PRESSURE VESSEL WELD WITH CONTROLLED RESIDUAL ELEMENTS
R. T. King, J. O. Stiegler, and G. M. Goodwin May 1973 32 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4131) Avail: NTIS HC $4.00

A SMA-type 308 stainless steel pressure vessel test weld with the controlled residual elements (CRE) boron (0.007%), titanium (0.06%), and phosphorus (0.04%) was tested in creep between 482 and 650 C. Improved ductility compared with that of standard welds in tests lasting several thousands of hours is associated with the absence of interphase separation. Systematic variations of microstructure and creep properties through the weld in the heat affected zone are due to thermal and mechanical cycling during the welding process. Anisotropic deformation occurs and is related to local substructure and preferred crystallographic orientation. Creep strengths are acceptable by present design rules. Author (NSA)

N74-17245# Naval Research Lab., Washington, D.C.
DISCUSSION OF THE POSSIBLE DOSE RATE EFFECT IN IRRADIATION OF PRESSURE VESSEL STEEL
Jr. Serpan C. Z. Aug. 1973 17 p refs
(Contract AT(49-5)-2110)
(NRL-Memo-2627) Avail: NTIS HC $3.00

The available theoretical and experimental evidence related to the dose rate effect in low alloy steel has been reviewed and is discussed. The conclusion reached is that trends in steel hardening and embrittlement by neutron irradiation are not noticeably influenced by the rate of irradiation when the rates (fluxes) are between 10 to the 10th power and 10 to the 14th power n/sq cm xsec/s and the fluence received is smaller than 1 x 10 to the 20th power n/sq cm greater than 1 MeV. Thus, although no evidence is available to validate a dose rate effect in radiation damage of ferritic steels, this effect should be considered and constantly sought in future results of experimental and operating reactor irradiation data. Author (NSA)

N74-17246# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.
REFRACTORY-ALLOY COMPATIBILITY WITH PLUTONIA-238 AT 1800 C AND 2000 C
J. D. Watrous and W. E. Ferguson Aug. 1973 84 p refs
(Contract AT(45-1)-2138)
(MDC-G4417) Avail: NTIS HC $5.45

Investigation of refractory alloy compatibility with plutonia-238 at 1800 and 2000 C indicated that rhenium exhibited the least attack from plutonia. Variables included in the study were refractory alloy composition (W, W-25Re, Re, Mo, Mo-50Re, and W-30 Mo-30Re), plutonia purity, plutonia stoichiometry, temperature, and time. The test specimens consisted of 0.25-g plutonia pellets in contact with two polished metal discs, all in a thick wall pressure vessel type container of the same alloy. General solution, intergranular precipitation, oxide precipitation, void formation, and intermetallic compound formation were observed in the different test specimens primarily to depths of less than 10 mils but much deeper for tungsten. Both the alloys and plutonia mass transported within the capsules. The relatively small plutonia volume resulted in minimal effect of plutonia purity. Several effects of test variables prevented development of mathematical expressions for alloy penetration as functions of temperature and time. Author (NSA)

N74-17247# Sandia Labs., Livermore, Calif.
WELDABILITY EVALUATION OF SEVERAL PRECIPITATION-HARDENING AUSTENITIC STAINLESS STEELS
P. B. Lindsay Aug. 1973 33 p refs
(Contract AT(29-1)-789)
(SLL-73-22) Avail: NTIS HC $3.75

High-purity A-286 alloys were produced and evaluated for weldability. The chemistries departed from that of the conventional alloy in three distinct ways: in the absence of the high-temperature alloying elements, B, Mo, and V; in the absence of the normal impurities, Si, P, and Mn; and in the presence of higher Ti. The weldability, as measured by the study of both the fusion zone and heat-affected zone in electron beam welds, showed dramatic improvement. The work also showed that higher titanium content can be used to work toward the goal of greater strength without injuring weldability if the higher-purity material is used. Author (NSA)

N74-17248# Los Alamos Scientific Lab., N.Mex.
CORRELATION BETWEEN DIFFUSION ACTIVATION ENERGY, HEAT OF FUSION, AND BINDING ENERGY IN METALS
P. P. Kuzmenko 1972 10 p refs Transl. into ENGLISH from Metallofizika (USSR), no. 42, 1972 p 37-42
(Contract W-7405-eng-36)
(LA-TR-73-45) Avail: NTIS HC $3.00

The relations between the heat of fusion, the binding energy, and the diffusion activation energy in metals are established using Gruneisen's theory. NSA

N74-17249# Scientific Translation Service, Ann Arbor, Mich.
ROLE OF CARBIDE PRECIPITATION ON THE CREEP RUPTURE STRENGTH OF THE AUSTENITE FAMILY OF STAINLESS STEEL
T. Shinoda and R. Tanaka 1972 26 p refs Transl. into ENGLISH from Nippon Kinoku Gakkai Kaiho (Japan), v. 11, no. 3, 1972 p 180-191 Prepared for ORNL Sponsored by AEC
(ORNL-TR-2703) Avail: NTIS HC $3.50

An outline of recent studies is presented on the relationships between the precipitated states of carbides and creep rupture strength. The control of the precipitate dispersion by trace additions of Ti and Nb, and the relationships between the precipitated particles and creep rupture strength is discussed, considering mainly the 18-8 group of stainless steels. NSA

N74-17250# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
COMPOSITE MATERIALS. SILICON CARBIDE REINFORCED ALUMINUM Final Report [MATERIAUX COMPOSITES ALUMINIUM CARBURE DE SILICIUM RAPPORT FINAL]
Marchal and Cantagrel [1972] 53 p In FRENCH
(Contract DRME-70/488)
(Rept-6-466) Avail: NTIS HC $5.75

The manufacturing techniques and properties of silicon carbide reinforced aluminum are presented. Two techniques are proposed: fluid Al infiltration in a bundle of fibers; and colaminating of a set of fibers between two Al sheets. In both cases the SiC fibers are coated with Cu obtained from pyrolysis. The various levels of fibers are then mechanically linked by electrolytic deposition of Cu. The temperature dependence in air or vacuum of the SiC fibers imposes limitations on the processes described. Operating conditions are detailed. The first method resulted in a composite wire with seven SiC strands exhibiting a volumic fiber content of 55% and room temperature tensile limit at 130 h bars the second method, at 400-500 C, allows a plastic deformation coefficient of seven to nine percent. ESRO

N74-17251# Defence Research Information Centre, Orpington (England).
THE EFFECT ON BEHAVIOUR IN USE OF THE COMPOSITION AND STRUCTURE OF ALUMINIUM BRONZES
P. Weill-Couly and D. Arnaud Nov. 1973 26 p refs Transl. into ENGLISH from Fonderies (Paris), no. 322, 1973

p 123-135
(DRIC-Trans-3416; BR20705) Avail: NTIS HC $4.50

A variety of aluminum bronzes is now available to meet the many problems of corrosion, especially that due to sea-water. The favorable effect of nickel has often been mentioned in technical literature; further details are given. The percentage of nickel necessary to prevent corrosion in contact with sea-water varies with the proportion of aluminum in the alloy. The effect of the proportion of nickel on the type of decomposition of the beta phase, as well as results of corrosion tests, are given for annealed cast alloys. The phases of several alloys were studied by means of the microprobe. The special case of welded aluminum bronze assemblies was studied, and some examples of their industrial application are given. Author (ESRO)

N74-17252# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.

HEAT TREATMENT AND SCC SUSCEPTIBILITY OF AU 4 SG TYPE FORGED MATERIAL

H. P. VanLeeuwen and L. Schra Jan. 1973 27 p refs Sponsored by the Neth. Agency for Aerospace Programs
(NLR-TR-73014-U) Avail: NTIS HC $4.50

Material from aluminum, copper, magnesium alloy, and gold alloy, which were rejected after cracking in service, were given a variety of heat treatments. Material aged to peak hardness was susceptible to stress corrosion cracking at all ging temperatures. Overaging at temperatures around 160C gives a significant increase in stress corrosion cracking resistance while useful strength was retained. An additional one week aging at 160C of T6 material following conventional heat treatment made it virtually immune to stress corrosion without a significant loss of strength. Author (ESRO)

N74-17253# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.

FRETTING AND FATIGUE UNDER COMPLEX FATIGUE LOADS

H. P. VanLeeuwen, A. Nederveen, and H. H. Ruiter Feb. 1973 18 p refs Sponsored by the Directorate of Materiel Air, Roy. Neth. Air Force
(NLR-TR-73015-U) Avail: NTIS HC $4.00

Pin loaded lugs in 2024 T3 aluminum alloys were fatigued under a load compounded from a low frequency load with crenelated wave form and a high frequency sinusoidal load. The effects of tightness of fit, clamping pressure, and lubrication were investigated. Author (ESRO)

N74-17254# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.

STRESS INTENSITY FACTOR SOLUTIONS FOR A CORNER FLAW AT A HOLE AND THEIR APPLICATION TO DESIGN

R. J. H Wanhill Jan. 1973 30 p refs
(NLR-TR-73016-U) Avail: NTIS HC $4.50

Three proposed solutions for the stress intensity factor of a corner flaw at a hole with remotely applied stresses, are discussed. Two of these solutions were used in a calculation of crack propagation life of a quarter-circular flaw in a high strength titanium alloy (IMI 550) from various initial defect sizes up to a routine detection limit of 2.5 mm. It is shown that the three solutions are in fair agreement for quarter-circular flaws larger than the hole diameter, but there are large discrepancies for flaw sizes much smaller than the hole diameter. These discrepancies are reflected in the calculated crack propagation lives. It is considered that the discrepancies are sufficiently great to make it worthwhile to conduct a test program to determine an effective stress intensity factor for corner flaws at both remotely loaded and pin loaded holes. Author (ESRO)

N74-17255# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.

FATIGUE CRACK PROPAGATION DATA FOR TITANIUM SHEET ALLOYS, IMI 130 Interim Report

R. J. H. Wanhill, A. E. Meulman, and W. J. VanDerVet Feb. 1973 30 p refs Sponsored by Neth. Agency for Aerospace Programs
(NLR-TR-73024-U; IR-4) Avail: NTIS HC $4.50

The environmental fatigue crack propagation in sheet IMI 130 (low oxygen commercially pure titanium) is discussed. The environments were dry argon, normal air, distilled water, and 3.5% aqueous NaCl. Author (ESRO)

N74-17256# National Aerospace Lab., Amsterdam (Netherlands). Div. Structures and Materials.

STUDY OF THE GROWTH OF STRESS CORROSION CRACKS IN THE ALUMINIUM ALLOY 7075. PART 2: INVESTIGATION ON THE EFFECT AND THE ROLE OF THE CORROSION POTENTIAL

A. Hartman Nov. 1972 70 p refs Sponsored by the Neth. Agency for Aerospace Programs
(NLR-TR-72136-U) Avail: NTIS HC $6.50

Three types of stress corrosion tests (open circuit, constant potential, constant current) were applied to short transverse pre-cracked 7075 aluminum alloy specimens loaded in bending and immersed in a NaCl solution. The results could be qualitatively explained by the theory that in stress corrosion the reaction of major importance is the pitting reaction which, for aluminum and chloride, is Al + 3Cl(-)yields AlCl3 + 3(e). Author (ESRO)

N74-17257# Army Materials and Mechanics Research Center, Watertown, Mass.

NDT EVALUATION OF BALLISTICALLY IMPACTED LAMINAR COMPOSITE ARMOR STEEL

Richard Chait and Satrak DerBoghosian Aug. 1973 18 p refs
(DA Proj. 1F1-62205-AA-52)
(AD-769738; AMMRC-TR-73-37) Avail: NTIS CSCL 19/4

Various NDT procedures helped explain the structural degradation of laminar composite armor steel due to ballistic damage. This armor steel consists of a high-carbon, high-hardness (R sub c 50) backup plate. Since this material is being evaluated for its load-carrying capability, ballistic response for both ball and armor-piercing projectiles was examined with various tensile loads that were applied during impact. Plates left intact after ballistic impact were tested in tension until failure. Residual strength values were subsequently determined. Prior to residual strength determination, the plates were magnetic-particle inspected. Ballistically induced crack formation was observed and analyzed. The influence of applied load during impact was determined. Subsequent residual strength values are interpreted in light of the crack formation revealed by magnetic particle inspection. Another ballistically induced defect is delamination that is produced between the hard and soft sides. It was found that the extent of delamination could be satisfactorily determined by ultrasonic C-scan pulse-echo technique. (Modified author abstract) GRA

N74-17258# Watervliet Arsenal, N.Y.

FRACTURE TOUGHNESS AND CRACK GROWTH MEASUREMENTS WITH C SHAPED SPECIMENS

D. P. Kendall, J. H. Underwood, and D. C. Winters Oct. 1973 38 p refs
(PRON Proj. M7-2-P4304)
(AD-769605; R-WV-T-6-39-73) Avail: NTIS CSCL 11/6

A series of C shaped fracture toughness specimens from 4330 steel forged cylinders have been tested using the general test procedure recommended by ASTM-E399. A wide range of specimen sizes were tested and no significant size effect on the fracture toughness, as measured by this specimen, was found. Crack growth during fracture toughness tests was measured using an ultrasonic technique. Based on these results and on a compliance analysis, the use of a five percent secant offset fracture criterion is recommended for this specimen. Standardized specimen dimensions for use of the C shaped specimen for testing a variety of thick-walled cylinders are recommended. Author (GRA)

N74-17259# Westinghouse Astronuclear Lab., Pittsburgh, Pa. Astronuclear Lab.

HARDNESS, STRENGTH AND ELONGATION CORRELATIONS FOR SOME TITANIUM-BASE ALLOYS Interim Technical Report, 1 Nov. 1971 - 15 Mar. 1972

W. A. Houston, T. E. Jones, D. J. Abson, and F. J. Gurney Jun. 1973 74 p refs
(Contract F33615-71-C-1163; AF Proj. 7351)
(AD-769763; AFML-TR-73-103) Avail: NTIS CSCL 11/6

Previously published results of aluminum-base alloys and

steels showed that accurate prediction of yield stress and ultimate tensile stress was possible from hardness data. The present study was undertaken to see if the relationships were also obeyed by titanium-base alloys. The intention was to permit exploitation of the economic advantages which would result from a saving in machining cost and in testing time, if the judicious use of hardness testing were to provide data approximately equivalent to that obtained by tensile testing. Rockwell hardness and tensile data obtained in an earlier study on three titanium base alloys (Ti-13V-11Cr-3Al, Ti-5Al-2.5Sn and Ti-6Al-4V) have been augmented with Meyer, Vickers and Knoop hardness measurements. The tensile data have been analyzed to give the work hardening coefficient. An attempt was also made to estimate points along the tensile curve from Meyer hardness data. (Modified author abstract) GRA

N74-17260# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
ON THE DETERMINATION OF CONSTITUTIVE EQUATIONS FROM PLASTIC WAVE PROPAGATION PHENOMENA Report for Sep. 1971 - Dec. 1972
T. Nicholas Sep. 1973 36 p refs
(AF Proj. 7351)
(AD-770027; AFML-TR-73-73) Avail: NTIS CSCL 11/6

Numerical results of a computer analysis are presented for two problems involving the propagation of plastic waves of uniaxial stress in long rods or bars. Characteristics of the wave propagation phenomena are determined for assumed materials which exhibit strain-rate dependent material behavior of the form proposed by Malvern, using the exponential form of the plastic strain rate function. The results are examined with regard to their uniqueness and sensitivity to the constitutive equation for cases involving the propagation of strain increments in a prestressed rod and for a suddenly applied constant velocity at the end of a long rod. Comparisons are made with predictions of the rate-independent theory of plastic wave propagation using both the static stress-strain curve and a single dynamic curve. The interpretation of experimental results in terms of a proposed constitutive law is discussed. GRA

N74-17261# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CORROSION AND ELECTROCHEMICAL BEHAVIOR OF ALLOYS OF THE Ti-Mo-Cr SYSTEM IN SOLUTION OF ACIDS
N. D. Tomashov and Yu. S. Ruskol 29 Oct. 1973 11 p refs Transl. into ENGLISH from the publ. "Novyy Konstruktsionny Material - Titan" USSR, 1972 p 166-170
(AD-769994; FTD-HT-23-151-74) Avail: NTIS CSCL 11/6

The addition of chromium to alloys of the Ti-Mo system reduces the tendency toward repassivation caused by the presence of Mo. The alloy Ti-5Mo-10Cr, in the potential range 0.15-1.2 V, has the same low corrosion rate as titanium or the alloy Ti-10Cr. At potentials above 1.2 V the corrosion rate of Ti-Mo-Cr alloys increases. With an increase in Mo content from 5 to 20% in alloys of the Ti-Cr system the corrosion rate in the range of potentials of repassivation with respect to chromium increases. After the corrosion of alloys of the Ti-Mo system at potentials of repassivation, there occurs an increase in the surface layer of titanium and a decrease in molybdenum. GRA

N74-17262# Pisa Univ. (Italy). Inst. of Aeronautics.
THEORETICAL AND EXPERIMENTAL RESEARCH ON THE FATIGUE BEHAVIOUR OF CRACKED STIFFENED PANELS Final Technical Report
A. Salvetti, A. Frediani, and E. Grassi Feb. 1973 117 p refs (Contract DAJA37-72-C-1783)
(AD-769948; ARDG(E)-1535) Avail: NTIS CSCL 11/6

The report presents the results of research performed on the behavior of cracked, riveted, stiffened panels undergoing constant amplitude fatigue loading. The objectives of the research were twofold: (1) to evaluate the K rate relationship in riveted stiffened panels, and (2) to determine the fatigue endurance of the stringer as function of the crack length in the sheet. The stress intensity factor as well as the overloading of the stringers was evaluated through a computer program which was based on the finite element method. A rationale was further developed to determine the fatigue endurance of the stringers as function of the crack length in the sheet. Rates of fatigue crack growth as well as fatigue endurance of stringers were measured on 40 stiffened panels made of 2024-T3 and 7075-T6 aluminum alloy sheet. Panel dimensions, stringer geometry and stringer spacing were varied systematically. (Modified author abstract) GRA

N74-17263# Brown Univ., Providence, R.I.
THERMOMECHANICAL PROCESSING BETA TITANIUM Final Report, 11 May 1972 - 10 Aug. 1973
Donald H. Avery and Ned W. Polan Sep. 1973 37 p refs (Contract DAAG46-72-C-0165; DA Proj. 1W5-64603-D-385)
(AD-769937; AMMRC-CTR-73-30) Avail: NTIS CSCL 11/6

The response of the beta alloy TS6 (Ti: 10 Cr, 7 V, 3.5 Mo, 3 Al), to a wide variety of thermomechanical treatments has been investigated, including the effects of cold work on polygonized structures, the effects of cold-reduction temperature, and multi-stage aging. Combinations of strength and ductility can be manipulated within a wide range by varying the amount of cold work and the aging treatment. Mechanical properties are strongly dependent upon the mode of deformation during cold working and slight variations in alloy chemistry. Stress corrosion tests indicate superior performance of TS6 compared with similarly treated beta-120 VCA. A scale-up of ingot melting and processing techniques has been accomplished. Ingots of TS6 weighing twenty-eight pounds have been prepared using a master-alloy technique. Hot extrusion at 1800F has yielded two-inch diameter rod which has been successfully cold press-swaged 20% and cold rolled 90%. Compared with previous one-pound heats of TS6, this material overages earlier, at somewhat lower hardness levels, and with more rapid kinetics. (Modified author abstract) GRA

N74-17264# California Univ., San Diego. Inst. for Pure and Applied Physical Science.
MAGNETIC PROPERTIES OF METALS AND ALLOYS UNDER PRESSURE Final Report, 1 Jul. 1971 - 30 Sep. 1973
D. K. Wohlleben and M. B. Maple 5 Oct. 1973 11 p refs (Grant AF-AFOSR-2073-71; AF Proj. 9764)
(AD-770062; AFOSR-73-1985TR) Avail: NTIS CSCL 20/12

A new technique for measuring the magnetization of materials over a wide range of pressures and temperatures was developed. Because of its high sensitivity, this technique opened up a new field: The pressure dependence of weak metallic susceptibilities. The technique employs a Faraday magnetometer, miniature pressure clamps, and a novel method for compensating the background magnetization of the clamps. Emphasis was placed on pressure-induced magnetic-nonmagnetic transitions in metals. These were documented for the first time by magnetic measurements on certain rare earth metals, their alloys and compounds, and itinerant ferromagnets. As a result of this work, a new class of nonmagnetic rare earth materials with nonintegral valence was recognized. Author (GRA)

N74-17265# Boeing Aerospace Co., Seattle, Wash.
EXPLORATORY DEVELOPMENT ON THE HYDROGEN EMBRITTLEMENT OF HIGH STRENGTH STEEL DURING MACHINING Final Report, 1 Apr. - 30 Jun. 1973
Bhagwan K. Das Sep. 1973 95 p refs
(Contract F33615-73-C-5120; AF Proj. 7312)
(AD-770216; AFML-TR-73-244) Avail: NTIS CSCL 11/6

The experimental program was undertaken to investigate the possibility of machining fluids being a source of hydrogen for a given high strength aerospace structural alloy. Unexpected catastrophic failure of high strength steel structures can occur as a result of hydrogen embrittlement if the material absorbs high levels of hydrogen during fabrication or when the hardware is in use. Test specimens made of AISI 4340 high strength steel of known hydrogen concentration were subjected to a specified schedule of gentle and abusive milling and grinding operations using different machining fluids. Following the machining operations the specimens were analyzed for excess hydrogen above the base level with a Boeing developed Ultrasensitive Hydrogen Analysis System. A total of six different machining fluids with different active chemical components were used in this study. Experimental results are presented with a statistical analysis of the hydrogen concentration data. (Modified author abstract) GRA

N74-17266# Syracuse Univ., N.Y. Dept. of Chemical Engineering and Metallurgy.
REFRACTORY INTERMETALLIC COATINGS Report for 15 Jul. - 15 Oct. 1973
Peter Ficalora 26 Oct. 1973 6 p refs
(Contract N00017-72-C-4424)
(AD-769880; MET 1706-QP-7) Avail: NTIS CSCL 11/6

Transmission electron diffraction of -400 A films of HfPt3 showed a strained face centered cubic structure. Reflection high energy electron diffraction is being used to characterize thick films (=10,000 A). High temperature flame tests show the refractory nature of thick HfPt3 films. Author (GRA)

N74-17267# Frankford Arsenal, Philadelphia, Pa.
METALLURGICAL ADVANCES FOR ALUMINUM CARTRIDGE CASE APPLICATION
Henry P. George Jun. 1973 77 p refs
(DA Proj. 1W5-22604-A-010)
(AD-769861; FA-R-2081) Avail: NTIS CSCL 11/6

Previous ballistic tests indicated that the acceptance of a small arms, high-performance, aluminum alloy case required the development of aluminum alloy materials with strength and toughness combinations superior to those available in alloys commercially produced. Exploratory tests indicated that, when homogenized to contain less than 0.2 volume percent secondary phases, two new alloys (MA56 and MA61) which utilize high purity ingredients had a strength-toughness approaching that considered necessary. At a slightly lower strength level, alloy 7475 was found to have excellent toughness. A novel thermal mechanical treatment was employed to selectively harden the head. This cartridge case was used in conjunction with an invention (called a flexible internal element) to thwart accidental aluminum case burn-through and successfully demonstrated the flexibility of aluminum cases in high-performance small caliber ammunition. (Modified author abstract) GRA

N74-17268# Rutgers Univ., Newark, N.J. Materials Research Lab.
MECHANICAL PROPERTIES AND HIGH-TEMPERATURE STABILITY OF Ti-Mo-Al ALLOYS Technical Report, 1 Apr. 1972 - 30 Jun. 1973
T. Hamajima, M. Hida, and S. Weissmann Sep. 1973 23 p refs
(Contract F33615-72-C-1566; AF Proj. 7353)
(AD-770343; AFML-TR-73-226) Avail: NTIS CSCL 11/6

The phase diagram of the isopleth section of the Ti-7 at % Mo-Al system has been improved and expanded to include alloys up to 25 at % aluminum. The mechanical and thermal stability of alloys aged in the two-phase region, beta - Ti3Al, and in the three-phase region, beta - alpha - Ti3Al, were correlated to the microstructures. Considerable increases in high-temperature strength and ductility, as well as high-temperature stability, were achieved in a Ti-7 at % Mo-16 at % Al alloy by step-aging. (Modified author abstract) GRA

N74-17269# Naval Research Lab., Washington, D.C.
FRACTURE EXTENSION RESISTANCE OF ALUMINUM ALLOYS IN THIN SECTIONS Final Report
R. W. Judy, Jr. and C. A. Griffis 12 Oct. 1973 15 p refs
(AD-770122; NRL-7627) Avail: NTIS CSCL 11/6

The Dynamic Tear (DT) test was developed to characterize the fracture resistance properties of structural metals over the entire range of strength and fracture properties. Ratio Analysis Diagram (RAD) procedures based on use of the DT test have been developed as a framework for determining the significance of fracture resistance data in terms of structural design parameters. However, DT test methods have been used primarily for thick-section materials (1.0 in. and thicker); hence no standard method for measuring fracture properties of thin-section ductile materials presently exists. This report is concerned with the extension of DT test methods to include thin-section materials in the RAD analysis system. The test materials were four thin-section aluminum alloys. A technique of laminating specimens was developed to prevent specimen buckling. Methods for comparing thin-section material properties to previously established data for aluminum alloys in thicker sections on the RAD format are also discussed. Author (GRA)

N74-17270# California Univ., Berkeley. Dept. of Mechanical Engineering.
WORKABILITY THEORY OF MATERIALS IN PLASTIC DEFORMATION PROCESSES Technical Report, 22 Jun. 1972 - 15 Apr. 1973
Shiro Kobayashi, C. H. Lee, and S. I. Oh May 1973 99 p refs
(Contract F33615-72-C-1645; AF Proj. 7351)
(AD-770205; AFML-TR-73-192) Avail: NTIS CSCL 11/6

The investigation is aimed at establishing a workability criteria in upsetting and rolling with reference to occurrence of free surface cracks. A review of the background on workability is given, indicating the need for methods of analysis which provide the required information on the mechanics in metal-working processes. The development of such a method is described. With this method, the workability criterion of SAE 1040 steel in upsetting, based on the observed fracture condition, is described. Although workability in rolling was not examined in this investigation, it appears possible by the developed theory to construct a workability criterion also in rolling. Author (GRA)

N74-17271# Northrop Corp., Hawthorne, Calif. Aircraft Div.
CORRELATION OF PROPERTIES AND MICROSTRUCTURE IN WELDED TITANIUM ALLOYS Final Report, 15 Jun. 1972 - 15 Jun. 1973
K. C. Wu Sep. 1973 128 p refs
(Contract F33615-72-C-2015; AF Proj. 7351)
(AD-769919; NOR-73-110; AFML-TR-73-202) Avail: NTIS CSCL 11/6

The purpose of this program was to conduct a systematic investigation to correlate the metallurgical reactions during welding to the mechanical properties and microstructures in a Ti-6Al-6V-2Sn weldment. To study the fusion-zone microstructure resulting from various welding processes (cooling rates) and its mechanical properties, four welding processes, manual gas tungsten-arc welding, plasma arc welding, automatic gas tungsten-arc welding, and electron beam welding, were used. Thermal cycles in the heat-affected zone near the fusion line were measured for the four welding processes and the cooling rates from 2500F were interpolated or extrapolated. Thus, a correlation between welding processes, cooling rates, and the continuous-cooling transformation diagram was established and the relationships between the characteristics of welding processes and CCT diagrams could be identified. (Modified author abstract) GRA

N74-17272# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE EFFECT OF THE MODE OF COLD DEFORMATION ON THE RECRYSTALLIZATION AND SUBSEQUENT GRAIN GROWTH OF Ti-5Al-2.5Sn M.S. Thesis
Richard E. Rumph Jun. 1973 65 p refs
(AD-770083; GAW/MC/73-12) Avail: NTIS CSCL 11/6

The effect of the type of deformation on the recrystallization and subsequent grain growth of Ti-5Al-2.5Sn was investigated for tension, compression, and swaging. The amount of cold work (as measured by true strain) was kept constant for each type of deformation. After annealing the specimens at 1600F (871C) for 30 minutes, the deformed tensile specimens had the smallest grain size, compression had the largest grain size, and swaging had a grain size between the other two. (Modified author abstract) GRA

N74-17273# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
A SECOND REPORT ON DEFORMATION MECHANISM MAPS Final Report
H. J. Frost and M. F. Ashby Aug. 1973 114 p refs
(Contract N00014-67-A-0298-0020; NR Proj. 031-732)
(AD-769821) Avail: NTIS CSCL 11/6

A crystalline solid can deform plastically in a number of ways. Deformation mechanism diagrams can be constructed which show the fields of stress and temperature in which a given mechanism is dominant and the strain-rate that it yields. This second report presents detailed maps for five pure f.c.c. metals (Ni, Cu, Ag, Al and Pb), six pure b.c.c. metals (V, Cr, Nb, Mo, Ta and W) and a recrystallized Ni - 1 vol% ThO2 alloy, which are based on direct comparison to available experimental data. It also presents further discussion of the various deformation

mechanisms, with refinements of their rate equations. Various applications of the diagrams are illustrated. They provide a convenient means for the normalized comparison of the behavior of different metals. They also demonstrate the effects of various changes in materials in a manner useful for qualitative engineering design. Author (GRA)

N74-17274# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.

THE EFFECTS OF HYDROGEN ON THE MECHANICAL PROPERTIES AND FRACTURE OF Zr AND REFRACTORY METALS

H. K. Birnbaum, M. Grossbeck, and S. Gahr Nov. 1973 27 p refs

(Contract N00014-67-A-0305-0020)

(AD-770235) Avail: NTIS CSCL 11/6

The effect of hydrogen on the mechanical properties of zirconium and the refractory metals is reviewed with particular attention to the effects on fracture and ductility. The various mechanisms proposed for the hydrogen embrittlement of these metals is reviewed. Both the effects of hydrogen in solution and in the surrounding gas phase is considered. New results on the embrittlement of Nb and Nb-N alloys obtained using a variety of experimental techniques is presented and discussed relative to the generic embrittlement phenomena in these metals. The relation of the crack propagation mechanism to stress and temperature induced phase changes is discussed and a model of hydrogen embrittlement is put forth. (Modified author abstract) GRA

N74-17275# Naval Ship Research and Development Center, Annapolis, Md.

DIFFUSION BONDING OF ALLOY TITANIUM FOR PRESSURE HULL FABRICATION

L. F. Aprigliano and C. A. Zanis Nov. 1973 33 p refs

(AD-770128; NSRDC-4177) Avail: NTIS CSCL 11/6

A diffusion bonding investigation of alpha-beta forded and alpha-beta rolled Ti-6 Al-2 Cb-1 Ta-0.8 Mo alloy titanium was undertaken as a first step in determining the feasibility of using out-of-chamber diffusion bonding for pressure hull fabrication. It was found that the mill processing history significantly affected the parameters necessary for bonding. The higher creep rate of the rolled material was primarily responsible for obtaining quality bonding at lower temperatures. It was also found that a total sample compression of more than 0.7% was necessary to obtain quality diffusion bonds. (Modified author abstract) GRA

N74-17276# Defence Research Information Centre, Orpington (England).

AN INVESTIGATION OF THE FRETTING FATIGUE STRENGTH OF BS L65 ALUMINUM ALLOY UNDER SINUSOIDAL AND NARROW BAND RANDOM CYCLIC STRESSING

R. J. Ryman and A. J. Billingham Jan. 1973 45 p refs

(AD-769883; BR33069) Avail: NTIS CSCL 11/6

Investigation of the fretting fatigue strength of L.65 Aluminum Alloy and S.98 Steel Pads showed that considered on an RMS stress basis, the Random amplitude loading fretting fatigue strength was almost identical with the Sinusoidal constant amplitude fretting fatigue strength. The Sinusoidal fretting fatigue strength was found to be comparable with previous findings. The plain unfretted Random fatigue strength was found to be approximately 65% of the unfretted constant amplitude loading. It would seem that for the conditions investigated, at the same RMS Constant Amplitude and Random stress levels, the crack initiation and rates of crack propagation are different although the nominal lives to failure are similar. The narrow band Random loading spectra was recorded, analysed, and the data used with Miners Cumlative Damage Rule and Sinusoidal fatigue data to predict the unfretted and Fretting Random fatigue lives. GRA

N74-17277# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PARTICULAR FEATURES OF THE STRUCTURE AND DECAY OF UNSTABLE BETA-SOLID SOLUTIONS OF THE Ti-V SYSTEM

S. G. Fedotov and K. M. Konstantinov 8 Nov. 1973 18 p refs Transl. into ENGLISH from Mono. "Novyi konstruktsionny Material" Titan 1972 p 48-56

(FTD Proj. 60107; FTD Proj. T74-01-10)

(AD-770462; FTD-HT-23-125-74) Avail: NTIS CSCL 11/6

Beginning at a point with approximately 13% V the titanium-vanadium beta-solid solution is supercooled to room temperature. With a smaller vanadium content the high-temperature beta-phase is unstable and during quenching out of the beta-region undergoes martensitic transformation. This work is concerned with studying the structure of the metastable beta-solid solution and the processes of phase transformations occurring in it at both room and elevated temperatures. GRA

N74-17278# Reynolds Metals Co., Richmond, Va. Metallurgical Research Div.

PROGRAM TO IMPROVE THE FRACTURE TOUGHNESS AND FATIGUE RESISTANCE OF ALUMINUM SHEET AND PLATE FOR AIRCRAFT APPLICATIONS

David S. Thompson, Sander A. Levy, Grant E. Spangler, and David K. Benson Sep. 1973 116 p refs Prepared in cooperation with Midwest Research Inst., Kansas City, Mo.

(Contract F33615-72-C-1202; AF Proj. 7351)

(AD-770350; AFML-TR-73-247-Vol-1) Avail: NTIS CSCL 11/6

A variety of thermomechanical processing practices have been investigated in 2000 and 7000 series alloys. These have been of the form: solution heat treat, quench, preage, work harden and final age. In Task I the effects of Cu (1.9 and 1.3%) and Mg (2.5 and 1.7%) content of 7000 series alloys were evaluated together with the preage and thermomechanical working conditions. It was found that the highest properties were obtained with the lower Cu and Mg contents, with an overaged preage followed by a warm rolling operation. These findings were incorporated in Task II in the choice of alloy (RX725: 6% Zn, 2.4% Mg, 1.5% Cu, and .12% Zr) and by concentrating an overaged, warm rolled processing conditions. It was found that the goals of the contract would be achieved; however, some unexplained low toughness values were obtained. (Modified author abstract) GRA

N74-17279# Ohio State Univ. Research Foundation, Columbus.

FUNDAMENTAL STUDIES OF DISSOLUTION AND PASSIVITY OF ALLOYS AND COMPOUNDS Annual Report, 1 Mar. 1972 - 28 Feb. 1973

R. W. Staehle and J. B. Lumsden Nov. 1973 51 p refs

(Contract N00014-67-A-0232-0006; NR Proj. 036-085)

(AD-770858; OSURF-3003-4) Avail: NTIS CSCL 11/6

Investigations of the properties of protective films on iron and the dissolution of bulk oxides are described. Using the techniques of ellipsometry and electrochemistry, studies have been conducted on the initial growth and dissolution of the films formed on iron surfaces exposed to a pH 8.7 borate buffer solution and to 0.1 N sodium tungstate solutions adjusted to pH's 7.4, 10, and 12. The steady state growth kinetics as well as the effects of temperature on the films also have been investigated. These results have been compared with the predictions of existing models describing film growth. The films formed in the tungstate solutions were found to be heterogeneous iron tungstates with an underlying iron oxide layer. The dissolution of the bulk oxides in a pH 0.0 chloride solution was studied. The solubility and also the rate of dissolution of Cr_2O_3 were found to be significantly lower than that of NiO. Author (GRA)

N74-17280# General Electric Co., Cincinnati, Ohio. Material and Process Technology Labs.

ODS FeCrAlY COMPONENT MANUFACTURING DEVELOPMENT Final Report, 22 Mar. 1972 - 22 Mar. 1973

R. E. Allen and R. J. Perkins 25 Nov. 1973 102 p refs

(Contract N00019-72-C-0397)

(AD-770639) Avail: NTIS CSCL 11/6

Process parameters were established for the fabrication of ODS FeCrAlY first stage nozzle vane material through a pilot manufacturing study and was then successfully scaled-up to full size vane blanks. Argon atomized powders were uniformly preoxidized and extruded using a modified SAP approach. Exaggerated grain growth was achieved for improved high

temperature strength properties through thermomechanical processing by isothermal forging and directional recrystallization techniques. The rupture strength goal was met. The vane blanks were determined to possess a duplex crystallographic orientation of (211) and (111). The (001) orientation was the sought after direction because of the low modulus of elasticity for improved thermal fatigue resistance. The high modulus orientations have serious implications for thermal fatigue resistance. A study for the modification of crystallographic orientation was initiated. A first stage nozzle vane has been designed for the testing of ODS FeCrAlY in a TF-34 engine at skin temperatures in excess of 2100F. (Modified author abstract) GRA

N74-17281# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF CORROSION INHIBITORS AND ADHESION PROMOTERS Final Report, 4 Apr. 1972 - 6 Jul. 1973
K. S. Rajan and P. K. Ase 25 Jul. 1973 52 p refs
(Contract N00019-72-C-0446)
(AD-770627; IITRI-C6252-7) Avail: NTIS CSCL 11/6

The treatment of aluminum alloys by (1) polyaminocarboxylic acids, (2) hydroxycarboxylic acids, (3) authraquinones, (4) diazo compounds and, (5) phthalocyanine have all been found to result in the deposition of a multimolecular layer of the individual ligands on the oxidic surface of the metal. Considerably improved paint adherence numbers were shown by the chelate-treated coupons over those of the conventional CHEMRITE-treated ones. However, in the salt splash tests, the unpainted coupons which had been chelate-treated showed decidedly more rapid corrosion attack than the CHEMRITE-treated ones. This could be due to the ease of washability of the surface-bound ligand. A pretreatment of the aluminum coupons with 0.5% CHEMRITE followed by surface chelation by alizarin and its analogs and phthalocyanine has shown not only considerably improved paint-adherence but also a satisfactory corrosion protection in comparison with the conventional CHEMRITE-treatment. GRA

N74-17282# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
DEVELOPMENT OF A NUCLEAR MICROPROBE TECHNIQUE FOR HYDROGEN ANALYSIS IN SELECTED MATERIALS Final Report, 18 Apr. 1972 - 18 Jul. 1973
Gerald M. Padawer and Philip N. Adler Oct. 1973 95 p refs
(Contract N00019-72-C-0404)
(AD-770856; RE-464) Avail: NTIS CSCL 11/6

The Lithium Nuclear Microprobe (LNM) has been developed to the point where it now is a unique and reliable nondestructive tool for the measurements of hydrogen concentration depth profiles in material surfaces. The hydrogen concentration calibration was performed using hydrogen-in-titanium NSB standards and Kapton, a polyimide film. Hydrogen surface concentrations were measured in cadmium and chromium plated D6AC steel samples, smooth and fractured Ti-6Al-4V surfaces that had been exposed to a stress corrosion environment, and smooth surfaces of 7075 aluminum alloys that had been exposed to conditions of stress corrosion. Hydrogen concentration depth profiles were measured in cadmium plated D6AC steel and 7075 aluminum alloy samples. Very high hydrogen concentrations found in these samples were linked to mechanical property degradation and corrosion. Thus the LNM has emerged as a proven, currently unmatched, diagnostic technique for accurate in situ measurements of localized hydrogen concentrations. (Modified author abstract) GRA

N74-17677 Ecole Nationale Superieure de Mecanique, Nantes (France).
FINE STRUCTURE STUDIES BY KOSSEL PATTERNS [ETUDE DES STRUCTURES FINES PAR LES DIAGRAMMES DE KOSSEL]
Man Hoat Nguyen and S. Offret *In its* Ann. 1972, Second Term 1972 p 163-172 refs In FRENCH (For availability see N74-17672 08-34)

N74-17678 Ecole Nationale Superieure de Mecanique, Nantes (France).
TUNGSTEN OXIDE THIN FILM PROPERTIES IN ALTERNATING CURRENT [PROPRIETES DES COUCHES MINCHES D'OXYDE DE TUNGSTENE EN COURANT ALTERNATIF]
K. H. Kim *In its* Ann. 1972, Second Term 1972 p 181-191 refs In FRENCH (For availability see N74-17672 08-34)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-17283* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NONFLAMMABLE COATING COMPOSITIONS Patent
Albert C. Krupnick, Carlo F. Key, and Roger J. Harwell, inventors (to NASA) Issued 8 Jan. 1974 4 p Filed 26 Sep. 1972 Continuation-in-part of abandoned US Patent Appl. SN-84212, filed 26 Oct. 1970
(NASA-Case-MFS-20486-2; US-Patent-3,784,499; US-Patent-Appl-SN-292382; US-Patent-Class-260-29.6S; US-Patent-Appl-SN-84212) Avail: US Patent Office CSCL 11C

Nonflammable coating compositions are described for use in high-oxygen environments which include an aqueous suspension of synthetic mica, an alkali metal silicate gelant and a waterbase latex resin emulsion. Inorganic white and/or color pigments and additives such as glass microballoons are employed to provide a wide range of colors and optical properties.
Official Gazette of the U.S. Patent Office

N74-17284+ Compagnie Generale d'Electricite, Marcoussis (France). Dept. Recherches Physiques de Base - Section Materiaux.
BARIUMSODIUM NIOBATE AND LEAD MOLYBDATE PREPARATION PERFECTION, SUPPLEMENT Final Report, 1971-1972 [MISE AU POINT DE LA FABRICATION DU NIOBATE DE BARYUM ET DE SODIUM ET DU MOLYBDATE DE PLOMB RAPPORT FINAL COMPLEMENTAIRE ANNEES 1971-1972]
Jean-Pierre Dumas, Gerard Villela, and Jean-Yves Boniort 1972 43 p refs In FRENCH
(Contract DGRST-70-02-170)
Avail: NTIS HC $4.25

The parameters determining scratch formation during the preparation of barium sodium niobate single crystals were studied. The nature of the scratches was investigated, and experimental conditions for avoiding scratch formation were elaborated. It was found that the crystals can be applied to continuous parametric oscillators. The characteristics of lead molybdate monocrystals, prepared by extraction from a melt, were determined. Transmission properties in the red and near infrared wavelength range were improved by a double extraction technique. The crystals can be applied for optical information treatment, such as deflection, declination, and correlation of two functions. ESRO

N74-17285*# Martin Marietta Corp., Denver, Colo.
THE DETECTION OF FATIGUE CRACKS BY NONDESTRUCTIVE TESTING METHODS Contractor Report, Nov. 1971 - Jun. 1973
Ward D. Rummel, Paul H. Todd, Jr., Sandor A. Frecska, and Richard A. Rathke Washington NASA Feb. 1974 158 p refs
(Contract NAS9-12276)
(NASA-CR-2369; MCR-73-145) Avail: NTIS HC $5.00 CSCL 11D

X-radiographic penetrant, ultrasonic, eddy current, holographic, and acoustic emission techniques were optimized and applied to the evaluation of 2219-T87 aluminum alloy test specimens. One hundred eighteen specimens containing a total of 328 fatigue cracks were evaluated. The cracks ranged in length from 0.500 inch (1.27 cm) to 0.007 inch (0.018 cm) and in depth from 0.178 inch (0.451 cm) and 0.001 inch (0.003 cm). Specimen thicknesses were nominally 0.060 inch (0.152 cm) and 0.210 inch (0.532 cm) and surface finishes were nominally 32 and

125 rms and 64 and 200 rms respectively. Specimens were evaluated in the as-milled surface condition, in the chemically milled surface condition and, after proof loading, in a randomized inspection sequence. Results of the nondestructive test (NDT) evaluations were compared with actual crack size obtained by measurement of the fractured specimens. Inspection data was then analyzed to provide a statistical basis for determinating the threshold crack detection sensitivity (the largest crack size that would be missed) for each of the inspection techniques at a 95% probability and 95% confidence level. Author

N74-17286*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATION OF COMMERCIALLY SUPPLIED SILVER COATED TEFLON FOR SPACECRAFT TEMPERATURE CONTROL USAGE
James B. Heaney Jan. 1974 35 p refs
(NASA-TM-X-70588; X-765-74-24) Avail: NTIS HC $4.75 CSCL 11C

A series of tests are described which were performed to evaluate the acceptability of a commercially supplied silver backed teflon thermal control coating relative to teflon previously coated at GSFC. Optical measurements made on numerous samples indicate that the commercial material possesses an average solar absorptance of 0.085, an emittance of 0.76 and an average alpha/epsilon equal to 0.112, all of which are equivalent to the GSFC coated teflon. The emittance of the protective inconel backing was found to be 0.037. The coating is shown to have good adhesion at the Ag-teflon interface and exposure to UV irradiation uncovered no coating irregularities. Temperature cycling over the range -135 C to +200 C produced crazing in the evaporated Ag layer as expected but no delamination was observed. The suitability of Mystik no. 7366 and 3M no. 467 adhesives as bonding agents for the metallized polymer is demonstrated. Various problems associated with production reproducibility and selection of a proper bonding process are discussed. Author

N74-17287*# TRW, Inc., Cleveland, Ohio. Materials Technology.
ENVIRONMENTAL PROTECTION TO 922K (1200 F) FOR TITANIUM ALLOYS Final Report
M. T. Groves Nov. 1973 112 p refs
(Contract NAS3-14339)
(NASA-CR-134537; ER-7704) Avail: NTIS HC $8.75 CSCL 11C

Evaluations are presented of potential coating systems for protection of titanium alloys from hot-salt stress-corrosion up to temperatures of 755 K (900 F) and from oxidation embrittlement up to temperature of 922 K (1200 F). Diffusion type coatings containing Si, Al, Cr, Ni or Fe as single coating elements or in various combinations were evaluated for oxidation protection, hot-salt stress-corrosion (HSSC) resistance, effects on tensile properties, fatigue properties, erosion resistance and ballistic impact resistance on an alpha and beta phase titanium alloy (Ti-6Al-2Sn-4Zr-2Mo). All of the coatings investigated demonstrated excellent oxidation protectiveness, but none of the coatings provided protection from hot-salt stress-corrosion. Experimental results indicated that both the aluminide and silicide types of coatings actually decreased the HSSC resistance of the substrate alloy. The types of coatings which have typically been used for oxidation protection of refractory metals and nickel base superalloys are not suitable for titanium alloys because they increase the susceptibility to hot-salt stress-corrosion, and that entirely new coating concepts must be developed for titanium alloy protection in advanced turbine engines. Author

N74-17288# Japan Atomic Energy Research Inst., Tokyo. Div. of Reactor Engineering.
PHYSICAL PROPERTIES OF GRAPHITE AND ITS THERMAL NEUTRON SCATTERING CHARACTERISTICS
Y. Nakahara Apr. 1973 65 p refs In JAPANESE, ENGLISH summary
(JAERI-M-5245) Avail: AEC Depository Libraries

Theoretical and experimental studies of the physical properties and thermal neutron scattering characteristics of graphite moderator are reviewed from the point of view of reactor physics, and calculations are also summarized. The descriptions, including discussions, include the following: the structure and properties of graphite, theoretical methods to analyze the lattice vibration of atoms in crystalline graphite, theoretical and experimental values of the frequency distribution, computational methods for the thermal neutron scattering cross sections, computer codes, data libraries and the computed and measured values of the scattering cross sections. Author (NSA)

N74-17289# Sandia Labs., Albuquerque, N.Mex.
EFFECTS OF MICROSTRUCTURE ON THE GRAPHITIZATION OF CVD/FELT COMPOSITES
B. Granoff Jun. 1973 44 p refs Sponsored by AEC
(SLA-73-686) Avail: NTIS HC $4.25

The kinetics of graphitization of two CVD/felt composites, prepared by the chemical vapor deposition (CVD) of carbon within carbon felt substrates, were investigated over a temperature range of 2300 to 2660 C and time intervals of 5 to 360 min. Each of these materials graphitized at a more rapid rate than massive chemical-vapor-deposited pyrolytic carbons. The graphitization rates of the CVD/felts were related to the matrix microstructures. The composite which had a rough laminar structure graphitized at two to three times the rate of one with a banded structure. The activation energies of the CVD/felt composites fell within the range (250 plus or minus 30 kcal/mole) observed for a wide variety of pyrolytic carbons and petroleum cokes. Author (NSA)

N74-17290# California Univ., Livermore. Lawrence Livermore Lab.
SUBSTRATES AND COATINGS: UNDERSTANDING CONVENTIONAL DEPOSITION TECHNIQUES IN THE FACE OF INCREASED SOPHISTICATION OF APPLICATIONS
W. F. Brunner and J. M. Khan 16 Jul. 1973 10 p ref Presented at Ann. Meeting on Soc. of Vacuum Coaters, Chicago, 28 Mar. 1973
(UCRL-74383; Conf-730325-2) Avail: NTIS HC $3.00

Demands in the fields of electronics, materials development for space, and optical coatings for lasers have produced a distinct increase in the sophistication of vacuum coating applications. Problems arise because the coatings have unique properties, not shared with the bulk material, and sometimes react with other materials in the deposition process in ways unpredictable by extension of practical experience. Methods of analyzing these effects have been limited in their application. Author (NSA)

N74-17291# European Space Research and Technology Center, Noordwijk (Netherlands). Materials Section.
OUTGASSING OF SPACE MATERIALS AND ITS MEASUREMENT [LE DEGAZAGE DES MATERIAUX SPATIAUX ET SA MESURE]
J. Dauphin and A. Zwaal 1973 35 p refs In FRENCH Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.75

The correlation between the results of several outgassing tests in Europe and the USA is reported. A temperature increase is the only possible way to obtain an accelerated test. Different standard methods have been established in the course of the past years, among which the micro-VCM test, utilized by ESTEC. Other, more progressive methods, exist, especially those using vacuum balances, which permit the study of outgassing and condensation at various temperatures. These methods are called absolute. ESRO

N74-17292# European Space Research and Technology Center, Noordwijk (Netherlands). Materials Section.
DETERMINATION OF THE THERMOOPTICAL PROPERTIES OF THERMAL CONTROL COATINGS [DETERMINATION DES PROPRIETES THERMO-OPTIQUES DES REVETEMENTS DE CONTROLE THERMIQUE]
F. Levadou and C. Minier Aug. 1973 40 p refs In FRENCH Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $5.00

Different methods of measuring and calculated the thermo-optical properties of thermal control coatings are presented. The exact knowledge of thermo-optical parameters is indispensable

in determining the temperature of different satellite components. Classic methods used to determine these properties are: (1) solar absorption measurement with an integrating sphere of central sample, using a spectrophotometer; and (2) dynamic emittance measurement, using a calorimetric method. Problems with respect to the mathematical treatment of data collected and the error analysis are discussed. Equipment for in-situ absorptance measurement was developed. ESRO

N74-17293# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Automatique.

METHODOLOGY CONCERNING THE SIMULATION OF IONIZING RADIATIONS WITH SPECIAL REFERENCE TO COATINGS WHEN IN GEOSTATIONARY ORBIT

J. Bourrieau, A. Paillous, J.-P. Philippon, J.-C. Giacomoni (Aerospatiale, Cannes, France), and A. Ziliani (Aerospatiale, Cannes, France) 1973 32 p refs Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.75

A method for evaluating the behavior of thermal control coatings of satellite in geostationary orbit is described. The mathematical principles of particle computation, and those used for calculation of the doses of energy absorbed by the materials, are discussed. The effects of the different proton and electron energy bands were evaluated. From this, the particle energies and fluxes to be used in environment simulation were deduced. Experimental results concerning aluminized kapton, aluminium paint Pyrolac PSG 108, OSR OCLI, and OSR RTC are presented. The method used can be applied to other types of orbit and to other internal or external components of the satellite. ESRO

N74-17294# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Automatique.

RADIATION DAMAGE MECHANISMS IN OPTICAL MATERIALS [LES MECANISMES DE DEGRADATION SOUS RAYONNEMENT DANS LES MATERIAUX OPTIQUES]

J. Bourrieau, J. C. Mandeville, and M. Romero 1973 23 p refs In FRENCH Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.25

Degradation mechanisms caused by space environment radiation in optical materials were investigated, and some results of simulation are presented. The faults produced depend not only on the component, the nature of the radiation (electrons, protons, micrometeoroids, X-rays, UV) but also on the irradiation conditions. Several examples are given to demonstrate the influence of various parameters and show the difficulties of a good simulation. They include: (1) the degradation of optical surfaces by micrometeroid, (2) the degradation of mirrors by proton irradiation, (3) the degradation in volume for color centers, and (4) vitreous ceramic material. ESRO

N74-17295# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Automatique.

MECHANISMS OF RADIATION DAMAGE IN POLYMERS

A. Paillous 1973 29 p refs Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.50

A survey of the degradation mechanisms in polymers when exposed to ultraviolet and particle irradiation, in order to optimize the environment simulation conditions, is presented. Interest is limited to chemical phenomena such as radiolysis and photolysis effects. It is pointed out that all exterior surfaces exposed to UV and particle radiations in space must be tested on the ground under combined environmental conditions, and that the polymeric materials used inside the spacecraft can be validly tested by monoenergetic electron irradiation. ESRO

N74-17296# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

REVIEW OF APPLICATION OF GLASS FIBER REINFORCED PLASTICS IN RESEARCH AND DEVELOPMENT PROJECTS FINANCED BY THE GERMAN BUNDESMINISTERIUM DER VERTEIDIGUNG AND BUNDESAMT FUER WEHRTECHNIK UND BESCHAFFUNG [UEBERSICHTSBERICHT UEBER DIE VERWENDUNG GLASFASERVERSTAERKTER KUNSTSTOFFE (GFK) BEIVOM BMVG UND BWB FINANZIERTEN FORSCHUNGS-UND ENTWICKLUNGSVORHABEN]

H. Wolff Bonn Bundeswehramt 1973 366 p Sponsored by X Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-17) Avail: NTIS HC $21.50; Bundeswehramt 101 DM

A summary of research and development results on glass fiber reinforced plastics obtained through orders of the Bundesministerium der Verteidigung and the Bundesamt fur Wehrtechnik und Beschaffung is presented. This summary was ordered according to expert points of view and possibilities of application. Systematic information is given on the orders, the technical and scientific know-how of the institutions concerned, and the effects on civil and military projects. Author (ESRO)

N74-17297# Hawker Siddeley Dynamics, Ltd., Hatfield (England). Space Div.

STUDY ON THE USE OF CARBON FIBRE REINFORCED PLASTICS IN SATELLITE STRUCTURES, PHASE 1 Final Report

J. A. Dickinson, comp. Oct. 1973 174 p refs Prepared jointly with UKAEA
(Contract ESTEC-1735/72-PP)
(HSD-TP-7427; ESRO-CR(P)-331) Avail: NTIS HC $11.75

Assessments of carbon fiber reinforced plastics (CFRP) as suitable materials for structural use in satellites are reported. Mechanical and physical property data of CFRP in environments typically encountered by satellites are discussed and compared to test the applicability of CFRP as structural materials. The performance data of other fiber reinforced plastics were collected and compared with those of CFRP. Proposals for future work are included. ESRO

N74-17298# Wayne State Univ., Detroit, Mich. Dept. of Physics.

ULTRASONIC STUDIES OF ELECTRONIC AND MAGNETIC PROPERTIES OF SOLIDS Final Technical Report

Robert L. Thomas Oct. 1973 17 p refs
(Grant AF-AFOSR-1965-71; AF Proj. 9763)
(AD-770085; AFOSR-73-1983TR) Avail: NTIS CSCL 20/12

Experimental and theoretical studies of the electromagnetic sound generation have been carried out in bismuth and gallium, resulting in a basic understanding of this effect. High field studies have contributed useful information on their electronic properties. Further studies have been made of the possible antiferromagnetic state of potassium. High resolution sound velocity instrumentation has been applied to studies of the magnetic properties of glasses alloys and crystals. Preliminary studies have been made of interactions of phonons with electrons in superconducting films. Author (GRA)

N74-17299# Fiber Materials, Inc., Biddeford, Maine.

THE 3-D STRUCTURES FOR NOSE TIP APPLICATIONS Final Report, Jun. 1972 - Aug. 1973

James E. Shoffner, Raymond B. Sylvain, Jeffrey Kahn, and Jack L. Cook Sep. 1973 19 p
(Contract DAAG46-73-C-0007; DA Proj. 1W0-62113-A661)
(AD-769936; AMMRC-CTR-73-35) Avail: NTIS CSCL 11/4

Preforms were woven in three directions, 3-D, with center-to-center spacings of 0.030, 0.040 and 0.125 inch using Thornel 50 and Thornel 400 yarns. The billets were partially densified with selected impregnants, pyrolyzed, and delivered at a 1.0 g/cc average density. The billets are being densified using chemical vapor deposition, and will be tested. (Modified author abstract) GRA

N74-17300# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

OXIDATION OF ALUMINUM NITRIDE M.S. Thesis

Bruce A. Rasmussen 22 May 1973 80 p refs
(AD-770038; GAW/MC/73-11) Avail: NTIS CSCL 11/2

The oxidation characteristics of hot-pressed aluminum nitride were investigated. Three materials were studied in the temperature range 1100 to 1400 C in 15, 150, and 400 torr oxygen environments. The oxidation process was evaluated using thermogravimetric measurements, X-ray diffraction, optical and

scanning electron microscopy and electron microprobe results. (Modified author abstract) GRA

N74-17301# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
FATIGUE CRACK GROWTH AND RETARDATION USING POLYCARBONATE M.S. Thesis
Daniel H. Banasiak Jun. 1973 71 p refs
(AD-769926; GAW/MC/73-3) Avail: NTIS CSCL 11/6

This experimental study investigated the retardation effects observed when tensile overloads were applied during fatigue tests of polycarbonate, a transparent polymer. Fatigue cracks were grown in 4-point bend polycarbonate specimens at constant stress intensity ranges in order to obtain constant fatigue crack growth rates. Peak overloads were then applied to the specimens in order to investigate their effects on subsequent crack growth. Simple optical methods were used to observe and photograph the crack tip front at the center of the specimen. Tensile overloads were shown to retard fatigue crack growth in polycarbonate in a manner similar to that observed in metals. Crack tip blunting and crack closure appeared to be associated with the retardation mechanism; however, their exact relationship was not investigated. It was concluded that polycarbonate offers potential as a model material for further retardation studies. Author (GRA)

N74-17302# General Electric Co., Philadelphia, Pa.
DEVELOPMENT OF CARBON-ALUMINUM COMPOSITE MATERIALS Final Report, 30 Jun. 1972 - 31 Aug. 1973
Joseph J. Gebhardt Sep. 1973 111 p refs
(Grant DAAG46-72-C-0185; DA Proj. 1W0-62113-A-661)
(AD-770474; AMMRC-CTR-73-36) Avail: NTIS CSCL 11/4

Exploratory development of a practical, continuous process with early scale-up potential for producing aluminum- or aluminum alloy-infiltrated tows of commercial graphite fiber was approached by application of selected coatings to the fiber surfaces through various chemical vapor deposition processes. Coating systems which were studied included (a) boron, (b) a boron-carbon (borocarbon) mixture, (c) silicon and (d) nitrided boron. Consecutive coatings of boron plus CVD aluminum were also investigated. The ability of coated fibers to be incorporated into aluminum-base composites was evaluated by means of vacuum infiltration and continuous melt/draw methods. Supporting studies included investigation of the interaction between molten aluminum and aluminum-4043 with representative surface coatings. Low fiber volume fraction experimental composites (3-10 vol. %) were evaluated by tensile or flexure tests together with optical and scanning electron microscopy. (Modified author abstract) GRA

N74-17303# Unidynamics/Phoenix, Ariz.
ASSESSMENT OF THE MILITARY APPLICATION OF UPAC, A POLYMERIZED ACRYLAMIDE Final Report
R. L. Curtin and Leonard Duran Feb. 1973 63 p
(Contract DAAD05-71-C-0302)
(AD-770046; LWL-CR-07C71) Avail: NTIS CSCL 11/9

Data characterizing the unique water absorption characteristic of UPAC, a proprietary acrylamide polymer was generated, and both laboratory and field feasibility studies were conducted in the following areas: Conditioning of tactical surfaces; purifying water-contaminated POL products; denial of potable water; disabling internal combustion engines; and demonstrating capability of expanding UPAC to perform useful work. It was found that UPAC can be successfully used for all of these applications in varying degrees. It appears to be especially useful for dust suppression, POL decontamination, engine disabling, and performing work, perhaps even a timing function. (Modified author abstract) GRA

N74-17304# Auburn Univ., Ala.
STABILITY OF GLASS FIBER-PLASTIC COMPOSITES Final Report, 19 Nov. 1971 - 19 Apr. 1973
Wartan A. Jemian and Roy C. Wilcox Oct. 1973 104 p refs
(Contract DAAH01-72-C-0294)
(AD-770479) Avail: NTIS CSCL 11/4

The results of the research show that the degradation that occurs in the S-glass epoxy composites takes place primarily in the glass structure at its surface. The effect of high humidity exposure on the strength of individual S-glass filaments and composites made up of S-glass roving and EPON 828/D was determined. The initial effect on the uncoated glass filaments is a loss of strength followed by stabilization with a slight recovery of strength on further exposure. The effect on the composite is always degradation. It was found, however, that the effect of water treatment on the glass roving before making up the composite reduced the general strength level but reduced the degradation rate and the scatter of strength in the group. (Modified author abstract) GRA

N74-17305# Army Foreign Science and Technology Center, Charlottesville, Va.
ADSORPTION OF ADDITIVES FROM OILS OF VARIOUS CHEMICAL COMPOSITION AND ITS CONNECTION WITH ANTIWEAR PROPERTIES
G. I. Kechkin, A. A. Markov, and V. L. Lashkhi 16 Jul. 1973 8 p refs Transl. into ENGLISH from Neftepererabotka i Neftekh. (USSR), no. 1, 1971 p 21-22
(AD-770094; FSTC-HT-23-1634-72) Avail: NTIS CSCL 11/8

The translation discusses a study of the adsorption of lubricants and additives on metallic surfaces. GRA

N74-17306# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
ABSTRACTS OF AF MATERIAL LABORATORY REPORTS JANUARY 1972 - DECEMBER 1972
Sep. 1973 205 p refs
(AF Proj. 7381)
(AD-770570; AFML-TR-73-143) Avail: NTIS CSCL 11/4

Technical reports published by the Air Force Materials Laboratory during the period 1 January 1972 - 31 December 1972 are abstracted herein. They are presented in groups corresponding to the divisions of the Laboratory. In addition to the abstract text, the report number, investigator, AFML project monitor, contractor, contract number, AFML project/task number, report date, and access numbers are given. Reports on research conducted by the Air Force Materials Laboratory personnel as well as that conducted on contract are included. Author (GRA)

N74-17307# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
PLASTICIZATION OF CARBON FIBERS
S. B. Warner, L. H. Peebles, Jr., and D. R. Uhlmann 9 Nov. 1973 19 p refs
(Contract N00014-67-A-0204-0065; NR Proj. 053-534)
(AD-770567; TR-3) Avail: NTIS CSCL 11/5

A technique is reported for temporarily plasticizing high modulus carbon fibers, which offers promise for permitting familiar textile operations to be carried out on them without mechanical damage. The technique consists of exposing the carbon fibers to a suitable material, such as bromine or iodine monochloride. These materials have the effect of plasticizing the fibers, perhaps temporarily lowering their moduli. In the plasticized state, the yarns can be made to take various shapes including sharp bends. On removal of the plasticizer, the yarn will retain a portion of the shape imparted to them. Tensile properties of the yarn and flexural properties of composites obtained on yarn that has undergone bromination and debromination show no changes relative to the untreated samples. Author (GRA)

N74-17308# Monsanto Research Corp., St. Louis, Mo.
COMPOSITE SHEAR STRENGTH: TUBE TORSION VS SHORT BEAM SHEAR
R. E. Lavengood and M. J. Michno, Jr. Oct. 1973 19 p refs Prepared in cooperation with Washington Univ., St. Louis, Mo.
(Contract N00014-67-C-0218; ARPA Order 876; NR Proj. 356-484)
(AD-770596; HPC-73-155) Avail: NTIS CSCL 11/4

Experimental evidence is presented for transversely isotropic glass-epoxy to show that shear strength determinations using the short-beam shear method (ASTM D2344-67) agree well with the results of tube torsion for a certain volume fraction range. In all cases short-beam shear results bound tube torsion results from below. Comparison of short beam and tube torsion shear strength may be a convenient measure of fabrication effectiveness. Author (GRA)

N74-17309# Army Materials and Mechanics Research Center, Watertown, Mass.
SILICON NITRIDE FOR STRUCTURAL APPLICATIONS: AN ANNOTATED BIBLIOGRAPHY Final Report
Donald R. Messier and Margaret M. Murphy Oct. 1973 67 p refs
(AD-770302; AMMRC-MS-73-3) Avail: NTIS CSCL 11/2

An annotated bibliography is presented of the work reported in the literature (1961-1973) on the fabrication and properties of reaction sintered and hot pressed silicon nitride. Also included is work on silicon oxynitride and Si-M type oxynitrides having the silicon nitride structure. Whisker growth, chemical reactions, mechanical behavior, and other related topics relevant to the processing and applications of silicon nitride are also included. Author (GRA)

N74-17310# Army Foreign Science and Technology Center, Charlottesville, Va.
LAMINATED PLASTICS IN CHEMICAL EQUIPMENT AND PIPELINES
A. A. Shevchenko and P. V. Vlasov 21 Jun. 1973 139 p refs Transl. into ENGLISH of the publ. "Sloistye Plastiki v Kaimicheskikh Apparatkh i Truboprovodakh" Moscow, Mashinostr. 1971 208 p
(AD-764433; FSTC-HT-23-75-73) Avail: NTIS CSCL 11/4

The Russian report gives a classification and nomenclature of laminated materials, their physiocomechanical characteristics, and their stability in corrosive media. Basic information on the failure mechanism of laminated plastics is presented. Methods of testing laminated plastics for corrosive stability, longevity, and creep are set forth. Methods of calculating and designing chemical equipment and pipilines made of laminated plastics are given. The book is written for designers of chemical equipment and engineering technicians in the chemical industry. Since there is a lack of data on the variation of the strength characteristics of laminated plastics in contact with chemically corrosive media in typical chemical processing conditions, the systematized calculation materials given in the book as well as methods for obtaining required data on strength and other characteristics of laminated plastics are intended to partially fill this gap. (Modified author abstract) GRA

N74-17311# Naval Ship Research and Development Center, Annapolis, Md.
ANTIFOULING ORGANOMETALLIC STRUCTURAL PLASTICS
J. A. Montemarano and E. J. Dyckman Aug. 1973 22 p refs (AD-767020; NSRDC-4159; NSRDC-28-734) Avail: NTIS CSCL 11/9

Various organometallic plastics such as polymethacrylates, polystyrenes, and polyesters were prepared by chemically incorporating biocidal organometallic compounds on polymeric backbones. Organometallic plastics will be used as coatings and structural plastics where antifouling protection is needed. The antifouling performance of these formulations was evaluated at NAVSHIPYD PEARL, Miami Beach, Florida, and this laboratory. Organometallic polymethacrylates and polyvinyls, previously synthesized, have exhibited 100% antifouling performance against a variety of marine organisms after 15 months of exposure at NAVSHIPYD PEARL. Author (GRA)

N74-17312# Pennsylvania State Univ., University Park. Dept. of Engineering Mechanics.
THERMAL EFFECTS, MICROSTRUCTURE AND STABILITY IN CONTINUUM MECHANICS Final Scientific Report, 1 Oct. 1968 - 30 Sep. 1973
Walter Jaunzemis and Jaan Kiusalaas Oct. 1973 15 p refs (Grant AF-AFOSR-1626-69)
(AD-770661; AFOSR-73-2037TR) Avail: NTIS CSCL 20/11

The report contains a brief review of technical accomplishments supported by the Grant. The research was focused on thermo-mechanical behavior of materials exhibiting nonhomogeneities (e.g. laminates, fiber-reinforced materials, inclusions, dislocations). Particular emphasis was placed on formulation of continuum theories that account for the nonhomogeneities. A complete listing of reports and publications that resulted from the research is included in the report. Author (GRA)

N74-16770* Windworks, Inc., Mukwanago, Wis.
THE USE OF PAPER HONEYCOMB FOR PROTOTYPE BLADE CONSTRUCTION FOR SMALL TO MEDIUM-SIZED WIND DRIVEN GENERATORS
Hans Meyer *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 73-74 (For availability see N74-16757 08-03)
CSCL 11D

N74-17673 Ecole Nationale Superieure de Mecanique, Nantes (France).
STUDY OF UNIDIRECTIONAL COMPOSITE MATERIALS USING THE FINITE ELEMENT METHOD [CONTRIBUTION A L'ETUDE DES MATERIAUX COMPOSITES UNIDIRECTIONNELS A PARTIR DE LA METHODE DES ELEMENTS FINIS]
B. Peseux and B. Sirot *In its* Ann. 1972, Second Term 1972 p 33-46 refs In FRENCH (For availability see N74-17672 08-34)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-17313 Georgia Inst. of Tech., Atlanta.
CONTROL OF SYSTEMS IN THE PRESENCE OF UNKNOWN BUT BOUNDED DISTURBANCES Ph.D. Thesis
Peter Derek Bergstrom 1973 97 p
Avail: Univ. Microfilms Order No. 73-29016

The problem is considered of control of dynamical systems operating in the presence of uncertainty. A control procedure is presented in which uncertainty, which may be either a deterministic function of time or a stochastic process, is described by only its bounds. No statistical modeling is used for this noise. The systems under consideration are described by a set of nonlinear differential equations. These equations are linearized about a specified nominal trajectory resulting in a linearized perturbation model. The region around the nominal trajectory containing the perturbed state is described by bounding ellipsoids. Using the trace of these ellipsoids as a performance index, this index is minimized subject to a constraint which is an ellipsoid generation algorithm. This minimization procedure results in a control algorithm. Dissert. Abstr.

N74-17314*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
DESIGN PROCEDURE FOR SATISFYING TIME DOMAIN BOUNDS FOR NONMINIMUM-PHASE SYSTEMS
William D. Ostheimer 1 Dec. 1972 82 p refs
(Grants NGR-06-003-083; NSF GK-33485)
(NASA-CR-136942) Avail: NTIS HC $7.25 CSCL 12A

Design techniques are presented applicable to nonminimum-phase systems. They are designed to handle plants with one right-half-plane zero which may vary, and any other variation of the plant parameters within known limits. The specifications that must be designed are given as a set of step response bounds in the time domain. A completed design will yield responses that stay within the time domain bounds at all times and utilize the entire region of allowed variation. Author

N74-17315*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLUTION OF AN EIGENVALUE PROBLEM FOR THE LAPLACE OPERATOR ON A SPHERICAL SURFACE M.S. Thesis - Maryland Univ.
Harvey Walden Feb. 1974 80 p refs
(NASA-TM-X-70591; X-582-74-41) Avail: NTIS HC $7.00 CSCL 12A

Methods for obtaining approximate solutions for the fundamental eigenvalue of the Laplace-Beltrami operator (also referred to as the membrane eigenvalue problem for the vibration equation) on the unit spherical surface are developed. Two specific types of spherical surface domains are considered: (1) the interior of a spherical triangle, i.e., the region bounded by arcs of three

great circles, and (2) the exterior of a great circle arc extending for less than pi radians on the sphere (a spherical surface with a slit). In both cases, zero boundary conditions are imposed. In order to solve the resulting second-order elliptic partial differential equations in two independent variables, a finite difference approximation is derived. The symmetric (generally five-point) finite difference equations that develop are written in matrix form and then solved by the iterative method of point successive overrelaxation. Upon convergence of this iterative method, the fundamental eigenvalue is approximated by iteration utilizing the power method as applied to the finite Rayleigh quotient. Author

N74-17316*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
BASIC ELEMENTS OF POWER SPECTRAL ANALYSIS
Davis D. Sentman Jan. 1974 62 p refs supersedes U-of-Iowa-73-24
(Grant NGL-16-001-002; Contract N00014-68-A-0196-0003) (NASA-CR-136931; U-of-Iowa-74-5; U-of-Iowa-73-24) Avail: NTIS HC $6.25 CSCL 12A

The basic elements of power spectral analysis with emphasis on the Blackman-Tukey method are presented. Short discussions are included on the topics of pre-whitening, frequency and spectral windows, and statistical reliability. Examples are included whenever possible, and a FORTRAN subroutine for calculating a power spectrum is presented. Author

N74-17317# Sheffield Univ. (England). Dept. of Probability and Statistics.
LIMITING DIFFUSIONS FOR THE CONDITIONED M/G/1
Douglas P. Kennedy Feb. 1973 13 p refs
(Rept-126/DPK-7) Avail: NTIS HC $4.00

The virtual waiting time process, W(t), in the M/G/1 queue is investigated under the condition that the initial busy period terminates but has not done so by time n equal to or greater than t. It is demonstrated that, as n approaches infinity, W(t), suitably scaled and normed, converges to the unsigned Brownian excursion process or a modification of that process depending whether rho does not = 1 or rho = 1, where rho is the traffic intensity. Author

N74-17318# Institut de Recherche d'Informatique et d'Automatisme, Roquencourt (France).
IDENTIFICATION, SIMULATION, AND RANDOM SIGNAL PROCESSING BASED ON GAUSSIAN MARKOVIAN REPRESENTATIONS [IDENTIFICATION, SIMULATION ET TRAITEMENT DE SIGNAUX ALEATOIRES A PARTIR DE REPRESENTATIONS GAUSSIENNES MARKOVIENNES]
Michel Clerget, Pierre Faurre, Francois Germain, and Francois Levieux 1973 21 p refs In FRENCH Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.25

A synthesis of work carried out on the problem of Markovian representation of random signals is presented together with their practical treatment, based on their statistical characteristics. For linear, and even nonstationary, systems, a general approach can be defined, as well as treatment algorithms; and it is relatively easy to interpret the results obtained for an identification problem, in the fields of filtering or control. ESRO

N74-17319# Technischen Universitaet, Munich (West Germany). Inst. fuer Astronomische und Physikalische Geodaesie.
REPRESENTATION OF THE MOTION OF A SATELLITE IN AN ANISOTROPIC GRAVITATIONAL FIELD BY POWER-SERIES [DARSTELLUNG DER BEWEGUNG EINES SATELLITEN IN EINEM BELIEBIGEN ANISOTROPEN GRAVITATIONSFELD MIT HILFE VON POTENZREIHEN]
Guenter Otto Dichtl Bonn Bundesmin. fuer Forsch. und Technol. Sep. 1973 60 p refs In GERMAN; ENGLISH summary
(Contracts WRK-132; SFB-78)
(BMFT-FBW-73-17) Avail: NTIS HC $6.00; ZLDI, Munich 12,60 DM

To solve the equation of motion of an artificial satellite in the anisotropic gravitation field of the earth as an initial value problem, the power series method was used. The necessary recurrence formulas for inertial polar coordinates were derived and an example for the possible application of this method is given. Author (ESRO)

N74-17320# Technische Hogeschool, Delft (Netherlands). Dept. of Aeronautical Engineering.
APPLICATION OF THE SOMMERFELD METHOD TO THE STRIP PROBLEM [DE METHODE VAN SOMMERFELD EN HET STRIP-PROBLEEM]
G. Schouten Oct. 1973 96 p refs In DUTCH; ENGLISH summary
(VTH-177) Avail: NTIS HC $8.00

The background of the Sommerfeld method is discussed in order to obtain insight into the possibility of applying the method to the strip problem. The most important underlying theories concern: (1) the generalization of solutions of the two dimensional Laplace equation to solutions of Helmholtz's equation (suggestion of Sommerfeld); and (2) manipulation on eigenfunction series to obtain an integral representation (following MacDonald). The first idea is applicable only to very simple functions. The second idea yields useful results only in polar coordinates. In effect the polar coordinates do play the crucial role in the possibility of applying the method. Some known applications of the method to the half plane problem are described. Experiments were carried out in which the method was applied to the strip problem. These experiments did not lead to useful integral relations, a negative result which is in accordance with the insight previously obtained. It is shown that the Sommerfeld method cannot be applied to the strip problem. ESRO

N74-17321# Ohio State Univ., Columbus. Div. of Statistics.
STATISTICS AND PROBABILITY APPLIED TO CONTROL SYSTEM ANALYSIS Final Report, 30 Jun. 1972 - 31 Aug. 1973
J. S. Rustagi 31 Aug. 1973 8 p refs
(Grant AF-AFOSR-2329-72; AF Proj. 9769)
(AD-769454; AFOSR-73-1988TR) Avail: NTIS CSCL 12/1

The research topics discussed in the paper include: Variational methods in statistics, inference in Markov dependent firing distribution; paired comparisons; sampling theory and its applications to the development of new sampling strategy for monitoring air pollutants; and, Pareto distribution. GRA

N74-17322# Washington Univ., St. Louis, Mo. Control Systems Science and Engineering.
DISTURBANCE LOCALIZATION IN LINEAR SYSTEMS WITH SIMULTANEOUS POLE-ASSIGNMENT OR DECOUPLING
Man-Feng Chang and Ian B. Rhodes 26 Apr. 1973 22 p refs
(Contract F44620-69-C-0116; Grant NSF GK-22905; AF Proj. 9749)
(AD-770102; CSSE-740; AFOSR-73-2039TR) Avail: NTIS CSCL 12/1

For a constant linear dynamic system with unmeasurable disturbances, geometric necessary and sufficient conditions are derived for the existence of a state-feedback controller that localizes the disturbances and simultaneously assigns the closed-loop poles or decouples the closed-loop system. These conditions are simple, intuitively appealing, and closely related to the known necessary and sufficient conditions for the separate problems to be solvable alone. Furthermore, it is shown that for these combined problems no additional flexibility is afforded by using dynamic compensation instead of static compensation. Under a standard dimensionality assumption, it is established that the combined problem of simultaneously localizing the disturbances, assigning the poles and decoupling the system has no solution. Author (GRA)

N74-17674 Ecole Nationale Superieure de Mecanique, Nantes (France).
EXPERIMENTAL DETERMINATION OF AN OPTIMAL PREDICTIVE FILTER [DETERMINATION EXPERIMENTALE D'UN FILTRE PREDICTEUR OPTIMAL]
C. Doncarli and P. DeLarminat *In its* Ann. 1972, Second Term 1972 p 67-72 refs In FRENCH (For availability see N74-17672 08-34)

N74-17675 Ecole Nationale Superieure de Mecanique, Nantes (France).

DEFINITION AND APPLICATIONS OF A FILTERING CRITERION WITH VARIABLE TIME SPAN [DEFINITION ET APPLICATIONS D'UN CRITERE DE FILTRAGE A HORIZON MOBILE]
Philippe DeLarminat *In its* Ann. 1972, Second Term 1972 p 133-149 refs In FRENCH Presented at the LAAS-GRETSI Conf. on le Filtrage Numerique et ses Appl., Toulon, France, 1-2 Jun. 1972 (For availability see N74-17672 08-34)

N74-17676 Ecole Nationale Superieure de Mecanique, Nantes (France).
SHIP PLATFORM MOVEMENT PREDICTION BY SELF ADAPTIVE FILTERING [PREDICTION DES MOUVEMENTS DE LA PLATEFORME D'UN NAVIRE PAR FILTRAGE AUTOADAPTIF]
C. Bozzo, (GESSY, Centre Univ. de Toulon, France), B. Cavallo, (GESSY, Centre Univ. de Toulon, France), and P. DeLarminat *In its* Ann. 1972, Second Term 1972 p 151-161 ref In FRENCH Presented at the Automatica 1972 Congr., Barcelona, 18-20 Oct. 1972 (For availability see N74-17672 08-34)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-17323 Wisconsin Univ., Madison.
THE GENESIS OF THE THERMAL THEORY OF CYCLONES Ph.D. Thesis
Gisela Kutzbach 1973 331 p
Avail: Univ. Microfilms Order No. 73-21007

The influence of the first law of thermodynamics on the development of Nineteenth-Century meteorology is traced. This law is regarded as a concept that unified meteorological research. This view is reflected in the continuity found in the development of theories of cyclones or storms - from the introduction of the first law of thermodynamics into meteorology in the 1860's to the achievements of the early Twentieth Century with regard to thermal aspects of storm formation and the source of kinetic energy in storms. Once the concept of conservation of energy had been clarified, investigators attempted on the basis of the theory of adiabatic temperature changes in dry and moist air, to evaluate the quantity of thermal energy associated with the release of latent heat. These investigations, in conjunction with empirical studies, led to the hypothesis that the thermal energy derived from the release of latent heat of condensation in ascending currents of air warmer than the environment, was a primary source of the kinetic energy exhibited in storms. Dissert. Abstr.

N74-17324 California Univ., San Diego.
THEORETICAL STUDIES OF URBAN HEAT ISLAND CONVECTION EFFECTS Ph.D. Thesis
Robert Lap-Sun Lee 1973 167 p
Avail: Univ. Microfilms Order No. 73-24504

Analytical and numerical flow calculations have been carried out to estimate vertical temperature profiles over a heated area representing a city. A physical understanding of the temperature structure over cities is important since observations indicate that the formation of weak elevated inversions will prevent effective dispersion of pollutants. Initially steady, planar, linearized flow is considered in a stable atmosphere with a constant stability and a constant effective eddy diffusivity for heat transfer. These linearized calculations predict the main effects observed over urban areas: positive temperature perturbations near the ground which will tend to cancel the early morning radiation inversion, and negative temperature perturbations aloft which will tend to produce one or more weak inversions several hundred meters above the city. Dissert. Abstr.

N74-17325 Bonn Univ. (West Germany). Inst. fuer Meteorologie.
A VERTICALLY INTEGRATED MODEL OF THE TRADEWIND LAYER Ph.D. Thesis 14 Jun. 1972 [EIN VERTIKAL-INTEGRIERTES MODELL DER PASSATSCHICHT]
Michael Hantel Fer. Duemmler's Verlag 1973 58 p refs In GERMAN; ENGLISH summary
(Bonn-Mi-16-1973) Copyright: Avail: Issuing Activity

A driven model of the lowest tropical-subtropical atmosphere was designed for the region from the equator to 30 deg latitude. Model equations are the conservation relations for horizontal momentum, mass, and enthalpy, integrated vertically from the sea surface up to a level which varies both horizontially and with time - the trade layer. Forcing functions are (a) the net energy input into the layer, (b) the so-called entrainment function which parameterizes the mass input due to large scale subsidence, and (c) the so-called hot tower function. A scale analysis was performed with the model equations. The nondimensionalized equations, in zonally symmetric form, were applied to the measurements of the Meteor research vessel for 1965 in the Atlantic; the results corrobrate previously discussed ideas concerning the latitudial profile of the entrainment and hot tower function. Subsequently, the nonlinear model equations were integrated for the case with specified forcing functions. The principle response of the model is: (1) development of a broad zone of a tropical easterly current, (2) a latitudinal pattern of thickness of the layer, and (3) a latitudinal pattern of energy content of the layer. Author (ESRO)

N74-17326*# Alaska Univ., Fairbanks. Geophysical Inst.
COORDINATED OBSERVATIONS OF CHEMICAL RELEASES FROM THE GROUND AND FROM AIRCRAFT AT HIGH LATITUDES Final Report, 1 Oct. 1972 - 30 Jun. 1973
Gerald J. Romick 30 Jun. 1973 41 p refs
(Grant NGR-02-001-094)
(NASA-CR-136944) Avail: NTIS HC $5.25 CSCL 04A

The ground observations of the Na-Li trail released from a Nike-Apache rocket obtained by the Geophysical Institute are discussed. By using the nominal trajectory for a 60 pound payload and the particular rocket, a best fit trajectory was determined based on the Ester Dome photographic data, launch time and earth-sun geometrical shadow height. From these calculations, the height of obvious features along the trail were determined and their velocity estimated. A clockwise rotation of the velocity vector with increasing height was observed. Velocities deduced at various altitudes were then compared to meter radar data also obtained during this period. The comparisons of these two neutral wind measurements techniques are satisfactory. Author

N74-17327# Environmental Protection Agency, Washington, D.C.
ATMOSPHERIC POLLUTION AND ITS EFFECTS ON VEGETATION
Marc Pellissier [1970] 51 p refs Transl. into ENGLISH of "La Pollution Atmospherique et ses Effets sur la Vegetation', Quebec Univ., Trois-Rivieres, report
(APTIC-51109; H477-53; TR-472-73) Avail: NTIS HC $5.75

Sources of atmospheric pollutants were studied along with the effects of pollutants on vegetation, and the geographic distribution of these effects. The pollutants discussed include SO2, fluorine, chlorine, particles, and oxides of nitrogen. The sources of the pollutants are determined to be paper mills, foundaries, and electrolysis processes. The sensitivities of plants to SO2 and other pollutants are tabulated. F.O.S.

N74-17328# Environmental Protection Agency, Washington, D.C.
POLLUTANTS OF THE FUTURE: NITROGEN OXIDES
R. Dumon [1973] 18 p Transl. into ENGLISH of Heurtey S.A., Paris, report
(APTIC-51105; H477-54; TR-501-73) Avail: NTIS HC $4.00

Nitrogen oxides are discussed as combustion products in the atmosphere. The formation of nitrogen oxides, and the sources on nitrogen oxide pollution are discussed along with the harmfulness of nitrogen oxides. F.O.S.

N74-17329# Swiss Inst. of Meteorology, Zurich.
FOEHN OF VALAIS [LE FOEHN DU VALAIS]
Max Boueet 1972 13 p refs In FRENCH; ENGLISH summary
Avail: NTIS HC $3.00

Wind measurements were recorded in Chippis near Sierre (canton Valais/Switzerland) from 1954 to 1970 without interruption. From this 17 years of recording, a complete

documentation was made of Foehn in the central part of the valley of the Rhone in the canton Valais. Mean and extreme values of frequency, duration and velocity of the warm winds was dealt with and the strong daily variation of frequency, with maxima between 3 and 6 o'clock p.m. is pointed out. The most frequent wind direction in the altitude is the one from SW to SSW. Author

N74-17330# Weapons Research Establishment, Salisbury (Australia).
MEASUREMENTS OF THE BASIC ATMOSPHERIC PARAMETERS AT WOOMERA USING THE FALLING SPHERE, JULY - DECEMBER 1972
P. H. O. Pearson Aug. 1973 59 p refs
(WRE-TN-1002(WR/D)) Avail: NTIS HC $5.00

During the second half of 1972 falling sphere experiments were continued on a monthly basis at approximately 6 deg solar depressing in the evening about 30 minutes after sunset. Six results are presented for atmospheric density, temperature, and wind components covering an altitude band of 30 to 100km. Density, temperature and pressure values are compared with those given by relevant models of the atmosphere. Author

N74-17331# Southampton Univ. (England).
ECONOMIC AND ECOLOGICAL APPROACHES TO THE OPTIMAL LEVEL OF POLLUTION
D. W. Pearce Feb. 1973 24 p refs
(Paper-7302) Avail: NTIS HC $3.25 CSCL 04B

A theoretical approach for identifying the source of the apparent incompatibility between scientists who argue for zero pollution and the economists who accept the theory of optimal externality. Mathematical models and graphs are developed to show the relationships between the theoretical and practical aspects of pollution elimination. One aspect of ecological arguments that are frequently is the emphasis on zero pollution as the optimum solution to environmental problems. It is stated that the essential point seems to be that ecosystems that have been allowed to evolve towards high maturity are able to withstand shocks, whereas systems with low maturity will not. Author

N74-17332# National Weather Service, Silver Spring, Md.
FORECASTING EXTRATROPICAL STORM SURGES FOR THE NORTHEAST COAST OF THE UNITED STATES
N. Arthur Pore, William S. Richardson, and Herman P. Perrotti Jan. 1974 73 p refs
(NOAA-TM-NWS-TDL-50) Avail: NTIS HC $6.75

The National Weather Service has developed a technique for forecasting extratropical storm surges along the northeast coast of the United States. The storm surge is caused mainly by the strong winds associated with extratropical storms over nearshore areas. Empirical forecast equations have been derived for 10 locations from Portland, Maine to Norfolk, Va. with data from 68 storms that occurred from 1956 through 1969. Input data to the technique are sea-level pressure values as forecast by the Primitive Equation (PE) model of the National Meteorological Center. Two versions of the method are available: an automated one that uses input data directly from the PE model and a manual one that can be used at forecast offices and depends on pressure forecasts from any source. Experience has emphasized the importance of accurate input sea-level pressure forecasts. Indications are that the system is useful. Plans are to expand it to include other locations. Author

N74-17333*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DIFFUSION FROM A LINE SOURCE
Rowland E. Burns 16 Nov. 1973 66 p refs
(NASA-TM-X-64804) Avail: NTIS HC $6.50 CSCL 04B

The problem with predicting pollutant diffusion from a line source of arbitrary geometry is treated. The concentration at the line source may be arbitrarily varied with time. Special attention is given to the meteorological inputs which act as boundary conditions for the problem, and a mixing layer of arbitrary depth is assumed. Numerical application of the derived theory indicates the combinations of meteorological parameters that may be expected to result in high pollution concentrations. Author

N74-17334# Israel Program for Scientific Translations, Ltd., Jerusalem.
LARGE-SCALE STRUCTURE OF NORTH ATLANTIC WIND FIELDS
R. V. Abramov 1973 10 p refs Transl. into ENGLISH from Izv. Vsesoyuznogo Geogr. Obschestva, (USSR), no. 2, 1972 p 123-129 Sponsored by NOAA and NSF
(TT-73-50012/3) Avail: NTIS HC $4.00

A procedure for calculating ocean wind fields based on ship observations of the actual wind was used to establish a large scale structure of the North Atlantic wind fields. Statistical processing was performed, grouping observations by calendar months within five degree or one degree trapezoids. Variations in the wind field structure due to the changing seasons and temperature are also considered. J.A.M.

N74-17335# Israel Program for Scientific Translations, Ltd., Jerusalem.
MESOSCALE FEATURES OF TROPICAL CONVERGENCE OVER THE ATLANTIC
R. V. Abramov and L. V. Kool 1973 17 p refs Transl. into ENGLISH from the publ. "Atmosfernye Protsessy v Tropicheskoi Zone i Ikh Svyaz's Protessami Vnetropicheskikh Shirot" Leningrad, Gidromet., 1971 p 15-31 Sponsored by NOAA and NSF
(TT-73-50012/2) Avail: NTIS HC $3.00

The intertropical convergence zone (ICZ) over the Atlantic common to mesometeorological and synoptic fluctuations is examined. The material comprises ship observations and radio-channel fascimile synoptic charts. About 130 basic (ground) charts and 100 streamline charts were processed. It was assumed that the position of the features of interest (ICZ, tropical waves and tropical cyclones appearing in its northern part, subtropical anticyclones) can be described by geographical coordinates at a given time: the position of cyclones and anticyclones is represented by their centers, and the ICZ position by its axis. It is convenient to approximate the latter by a broken line, measuring from the chart the latitude of the points at which the ICZ axis intersects the different meridians. The position of the line of wind discontinuity is similarly approximated. The position of the tropical wave can be defined conveniently by the coordinates of the middle of the axis of its trough. Author

N74-17336# Committee on Science and Astronautics (U. S. House).
RESEARCH ON SHORT-TERM WEATHER PHENOMENA
Washington GPO 1974 332 p refs Hearings on H.R. 9811 before Comm. on Sci. and Astronaut. 93d Congr., 1st Sess., No. 23, 6, 7, and 9 Nov. 1973
Avail: Subcomm. on Space Sci. and Applications

The hearings concerning research for forecasting tornadoes and other short-term weather phonomena are reported. Topics discussed include: the tornado cyclone project, research on short-term phenomena, application of NASA space technology in support of NOAA for detecting and predicting severe storms, and convective transport of mass in severe storms. F.O.S.

N74-17337# World Meteorological Organization, Geneva (Switzerland).
RADIATION PROCESSES IN THE ATMOSPHERE Global Atmospheric Research Program
K. Y. Kondratjev (Leningrad Univ.) 1972 269 p refs Presented at the 6th World Meteorol. Congr., Apr. 1971
(WMO-309) Avail: NTIS HC $16.50; WMO, Geneva

Data on atmospheric radiation processes are reported. Topics cover the solar constant, radiation characteristics of the underlying surface, radiation climatology of the earth, atmospheric aerosols and their influence on radiation transfer, and radiation, thermal regime, and dynamics of the atmosphere. For individual titles, see N74-17338 through N74-17342.

N74-17338 World Meteorological Organization, Geneva (Switzerland).
THE SOLAR CONSTANT c29
In its Radiation Processes in the Atmosphere 1972 p 1-16 refs (For availability see N74-17337 08-20)

The determination of the solar constant, the flux of solar radiant energy, is discussed. Balloon sounding measurements, including extrapolation methods for experimental values found,

are dealt with. The influence of atmospheric transparency variation and the dependence of the solar constant on the Wolf number are discussed. The most reliable maximum value of the solar constant at present is 1.94 cal/sq cm min, with an accuracy better than 1%. The extra-atmospheric distribution of energy in the solar spectrum is also discussed. ESRO

N74-17339 World Meteorological Organization, Geneva (Switzerland).
RADIATION CHARACTERISTICS OF THE UNDERLYING SURFACE
In its Radiation Processes in the Atmosphere 1972 p 17-48 refs (For availability see N74-17337 08-20)

Radiation characteristics of the earth surface, notably albedo and emissivity, are discussed. Mean albedo values such as those of various land surfaces as soils, vegetation covers, and snow covers are given along with values for water surfaces and other large areas. In addition, albedo of clouds and geographical distribution of albedo are dealt with. Measured values of emissivity of various kinds of surfaces are tabularized and the emissivity of clouds is discussed in detail. ESRO

N74-17340 World Meteorological Organization, Geneva (Switzerland).
RADIATION CLIMATOLOGY OF THE EARTH
In its Radiation Processes in the Atmosphere 1972 p 49-92 refs (For availability see N74-17337 08-20)

A comparative analysis of the computational and experimental climatology data of the earth's radiation budget was made. Methods for the evaluation of satellite measurement data on outgoing radiation are discussed. Albedo values as established by various authors are dealt with. Measurements and calculations of outgoing long wave radiation are discussed along with long wave radiation and total radiation budgets. ESRO

N74-17341 World Meteorological Organization, Geneva (Switzerland).
ATMOSPHERIC AEROSOLS AND THEIR INFLUENCE ON RADIATION TRANSFER
In its Radiation Processes in the Atmosphere 1972 p 93-132 refs (For availability see N74-17337 08-20)

The influence of solid dust aerosols on radiation transfer is discussed. The aerosol structure of the troposphere and stratosphere, including vertical distribution of aerosol concentration, size distribution, chemical composition, and index of refraction, is reviewed. Experimental studies in the vertical profiles of radiation fluxes and the influence of aerosols are dealt with, with particular emphasis on radiation fluxes in the troposphere and the lower stratosphere, long wave radiation budget, reflected and scattered radiation, albedo, and radiation temperature variations. Finally, the incorporation of radiative flux divergence in models of the general circulation is discussed taking into consideration the methods of Manabe and Strickler, Shifrin et al, and Plass and Kattawan. ESRO

N74-17342 World Meteorological Organization, Geneva (Switzerland).
RADIATION, THERMAL REGIME AND DYNAMICS OF THE ATMOSPHERE
In its Radiation Processes in the Atmosphere 1972 p 133-212 refs (For availability see N74-17337 08-20)

Aspects on the formation of the thermal regime of the surface layer and the free atmosphere, including vertical temperature distribution factors are discussed. The possibilities of direct radiative flux divergence measurements were also discussed. Emphasis is placed on radiative heat exchange in the troposphere and the stratosphere. The influence of cloudiness on radiation fluxes and radiative flux divergences was dealt with, particular reference being given to the methods of Manabe and Strickler, Katatayama et al., Sasamori, Feigelson, and Avaste. Finally, the formation of a temperature field and the influence of radiative flux divergence on the large scale atmospheric dynamics are discussed. ESRO

N74-17343# World Meteorological Organization, Geneva (Switzerland). International Commission of Polar Meteorology.
ENERGY FLUXES OVER POLAR SURFACES
Svenn Orvig, ed. 1973 307 p refs Proc. of Intern. Assoc. of Meteorol. and Atmospheric Phys./Intern. Assoc. of the Phys. of Sci. of the Ocean/Sci. Comm. on Antarctic Res./WMO Symp., Moscow, 3-5 Aug. 1971
(WMO-361; TN-129) Avail: NTIS HC $18.50; WMO, Geneva

Polar meteorological studies on energy fluxes in arctic and antarctic regions are presented. Topics include energy fluxes over land surfaces and over sea ice, wind studies, regional and global studies on large-scale energy fluxes, and interaction between ocean and atmosphere. For individual titles, see N74-17344 through N74-17357.

N74-17344 Uppsala Univ. (Sweden). Inst. of Meteorology.
THE ENERGY EXCHANGE IN THE SUPERIMPOSED ICE ZONE OF THE DEVON ISLAND ICE CAP IN SUMMER
Bjoern Holmgren *In* WMO Energy Fluxes over Polar Surfaces 1973 p 1-23 refs (For availability see N74-17343 08-20)

Vertical energy fluxes at the surface of the Devon Island ice cap were determined by micrometeorological measurements during the Arctic Institute of North America's Devon Island Expedition 1961-3. Variations of temperature in the surface layer were established, and the properties of the katabatic winds were investigated. The vertical turbulent transfer of both sensible and latent heat was calculated. Radiation fluxes were measured by various standard instruments. The energy exchange and, weather, and the synoptic weather situation are discussed. ESRO

N74-17345 Innsbruck Univ. (Austria). Inst. fuer Meteorologie.
SPECTRAL ENERGY DISTRIBUTION IN SHORTWAVE FLUXES OVER THE EAST ANTARCTIC PLATEAU
M. Kuhn *In* WMO Energy Fluxes over Polar Surfaces 1973 p 24-47 refs Sponsored by NSF (For availability see N74-17343 08-20)

Radiation fluxes in the spectral range below 4 microns as measured at Plateau Station, Antarctica, in the period 1966-1969 are used to characterize the scattering and absorbing processes in the Antarctic atmosphere. Direct solar radiation was measured in broad bands below 4000 nm. Values of the scattering coefficient of aerosol and its spectral variation, and of absorption on water vapor and ozone were determined. Global irradiation was monitored in the ranges 300 - 400, 525 - 2800 nm, and in the total spectrum. A model is presented for diffuse fluxes which helps to assess the contribution of atmospheric backscattering above the highly reflecting snow surface to diffuse irradiation. Evidence that cirrus type clouds and ice crystal precipitation usually increase rather than diminish global irradiation at the surface is given. Author (ESRO)

N74-17346 Alaska Univ., College.
SOME MEASUREMENTS OF THE DIURNAL VARIATION OF THE HEAT BALANCE IN CENTRAL ALASKA
Gerd Wendler *In* WMO Energy Fluxes over Polar Surfaces 1973 p 48-67 refs (For availability see N74-17343 08-20)
(Grant NSF GA-28278)

For a station situated near Fairbanks, Central Alaska, the heat balance was estimated for selected days of 1967. On a clear summer day the radiation budget was highly positive. At night the radiation balance was negative. On a cloudy summer day similar results were obtained, but with smaller fluxes. In autumn the radiation balance was positive during the day and negative during the night; the radiation balance for a 24 hour period became negative on cloudy days and stayed slightly positive on sunny ones. In mid-winter no diurnal change in the direction of the fluxes was observed. On cloudy days smaller fluxes were observed, with stronger variations. Author (ESRO)

N74-17347 Melbourne Univ., Parkville (Australia). Dept. of Meteorology.
ON THE ENERGETICS OF SURFACE WINDS OVER THE ANTARCTIC ICE CAP
U. Radok *In* WMO Energy Fluxes over Polar Surfaces 1973 p 69-100 refs (For availability see N74-17343 08-20)

The analogy between katabatic or inversion winds and the trades is explored in a discussion of energy transfers along an air trajectory from the interior to the rim of East Antarctica making use of Ball's katabatic wind theory. Except for latent heat, the largest single item in the heat budget of the trades, energy transfers of similar magnitudes seem to occur in the two wind systems which also show resemblance in horizontal

uniformity and in control mechanisms involving vertical subsidence and hydrometeors. However, the Antarctic surface flow is more sporadic and probably responds to synoptic events in the free atmosphere over the ice rather than to a largely internal feedback like the trades. Author (ESRO)

N74-17348 Norsk Polarinstitutt, Oslo.
ON WIND AND TEMPERATURE PROFILES ABOVE AN ANTARCTIC ICE SHELF
T. E. Vinje *In* WMO Energy Fluxes over Polar Surfaces 1973 p 101-114 refs (For availability see N74-17343 08-20)

During January 1959 wind speed and temperature were measured on a 27 m high tower at Norway Station, which was situated on an extensive ice shelf about 35 km south of the ice front in Antarctica. The profiles given are based on 20 min runs. They are selected for conditions when the wind speed was above 2m/sec and below 10 m/sec, to avoid influences of the cup-anemometers inertia and the effect of dense drifting snow. Topics discussed include net radiation and profile exponent, near adiabatic conditions, special wind profiles, and turbulent fluxes. Author (ESRO)

N74-17349 Department of Supply, Melbourne (Australia). Antarctic Div.
A SAMPLE STUDY OF THE ENERGY FLUXES PRECEDING AND ACCOMPANYING THE FORMATION OF ANTARCTIC SEA ICE
I. F. Allison *In* WMO Energy Fluxes over the Polar Surfaces 1973 p 115-132 refs (For availability see N74-17343 08-20)

During 1969 a micrometeorological station was operated on annual sea ice near Mawson. In addition, wind, temperature, and radiation measurements were made over open water and new ice from an instrumented raft. From the results, various factors in the energy balance equation were estimated and discussed in terms of short periods representative of the preformation and formation of the sea ice. Comparison between these two periods illustrates the large changes occurring in the energy fluxes when an ice cover is formed. The open water balance shows a strong diurnal variation, with the sea gaining radiant energy during the day and losing energy at night. The albedo increase on sea ice formation reduces the absorption of solar energy and the net radiation becomes negative. Both sensible heat and latent heat transfers are also considerably reduced.
Author (ESRO)

N74-17350 McGill Univ., Montreal (Quebec). Dept. of Physics.
ALBEDO OF THE ICE-INFESTED WATERS IN THE CHANNELS OF THE CANADIAN ARCHIPELAGO
M. P. Langleben *In* WMO Energy Fluxes over Polar Surfaces 1973 p 134-142 refs (For availability see N74-17343 08-20) (Grant NRC-A-4232)

Values of albedo for the ice cover in the waters of the Canadian Arctic were calculated from observations of total hemispherical shortwave radiation incident on the earth's surface and of that portion of the radiation reflected by the surface. The measurements were obtained between 24 June and 15 July 1970 in a series of ice-reconnaissance flights by the Ice Patrol aircraft of the Polar Continental Shelf Project. It was shown that reasonable estimates of albedo of the ice cover can be made from aircraft radiation measurements from good photographic coverage of the surface, or from quantitative descriptions of ice concentration and puddling of the ice surface by a trained observer. The variation of albedo with time is such that an overflight frequency of not less than once per two weeks is necessary. Author (ESRO)

N74-17351 McGill Univ., Montreal (Quebec). Dept. of Meteorology.
SYNOPTIC ENERGY BUDGETS FROM THE BEAUFORT SEA
E. Vowinckel and Svenn Orvig *In* WMO Energy Fluxes over Polar Surfaces 1973 p 143-166 refs (For availability see N74-17343 08-20)

The differences in energy budgets of the sea and ice surfaces in the polar ocean are the greatest that exist over short distances anywhere in the world. In order to study the conditions over the polar ocean, surface and radiosonde data from the Soviet station North Pole 7 in the Beaufort Sea in 1957-58 were used. All terms in the surface energy budget were calculated for every day of the year. All surface terms show pronounced differences over ice and water, the most conspicuous being in the sensible heat flux. Surface energy budget terms discussed include latent heat flux, turbulent terms, and radiative terms. The air mass modification was calculated for various stretches of open water. Author (ESRO)

N74-17352 New Zealand Meteorological Service, Wellington.
SURFACE HEAT BALANCE AND CLIMATE IN AN ICE-FREE AREA OF ANTARCTICA
D. C. Thompson *In* WMO Energy Fluxes over Polar Surfaces 1973 p 167-180 refs (For availability see N74-17343 08-20)

Results are presented of the first two years' continuous observations of meteorological and surface heat balance parameters at Vanda Station. The station is situated in South Victoria Land in an area of over 2500 square km that is substantially ice- and snow-free throughout the year. The climate features low precipitation, low humidities, and relatively low mean cloud cover. Temperatures are some 7 C warmer in summer and 7 to 10 C colder in winter than adjacent areas. Incoming solar radiation in summer is reduced by adjacent mountain ranges, but because the surface albedo is low the net flux of long- and short-wave radiation showed a positive balance. Soil heat flux measurements show that only a small fraction of the net flux above the surface passes through the heat balance of the surface being maintained by a relatively large rate of exchange of sensible heat between the ground surface and the atmosphere.
Author (ESRO)

N74-17353 Washington Univ., Seattle.
NUMERICAL SIMULATION OF THE INFLUENCE OF ARCTIC SEA ICE ON CLIMATE
J. O. Fletcher, Y. Mintz (Calif. Univ., Los Angeles), A. Arakawa (Calif. Univ., Los Angeles), and T. Fox *In* WMO Energy Fluxes over Polar Surface 1973 p 181-218 refs (For availability see N74-17343 08-20)

A comparison was made between the time-averaged distributions of the atmospheric variables in two numerical atmospheric general circulation experiments. The two experiments, which were made by long-term integration of the primitive equations of atmospheric motion, are identical in all respects except that in one experiment there is an ice cover over the Arctic ocean and in the other the Arctic ocean is ice free. To the extent that the "ice-in" experiment successfully simulates the temperature, circulation, and precipitation actually observed in the real atmosphere, one may believe the results of the "ice-out" experiment. Author (ESRO)

N74-17354 Articheskii i Antarkticheskii Nauchno- Issledovatelskii Institut, Leningrad (USSR).
ESTIMATION OF THE ENERGY BALANCE ELEMENTS OF THE POLAR ZONE OF THE NORTHERN HEMISPHERE (NORTH OF 50 DEG N)
Y. P. Borisenkov and M. S. Chernukhin *In* WMO Energy Fluxes over Polar Surfaces 1973 p 219-243 refs (For availability see N74-17343 08-20)

The proposed polar experiment (POLEX) is outlined. One objective of the research is to develop estimation techniques for thermal interaction between the atmosphere and the oceans in polar areas, using numerical hydrodynamic models. Individual components of the energy balance north of 50 deg N were evaluated and mechanisms responsible for the maintenance of the energy balance were investigated. Computations of meridional fluxes of useful potential energy for the Northern Hemisphere from 40 deg N northward were made. The results are given for 4 sectors: Atlantic, Eurasia, Pacific, and North America. The most distinct patterns are observed in winter, when intense flow of heat is directed into the polar zone from the Pacific, and also over the western part of the Elantic. Cold flow from the Arctic is observed over Lurasia and North America. Annual variations and latitudinal distributions of energy flow are shown for the four sections. Author (ESRO)

N74-17355 Hydrometeorological Scientific Research Center (USSR).
THE EFFECT OF LARGE-SCALE TROPOSPHERIC PROC-

ESSES UPON THE GEOPOTENTIAL FIELD VARIATIONS AND THE STRATOSPHERIC AIR CIRCULATION
K. P. Pogosyan *In* WMO Energy Fluxes Over Polar Surfaces 1973 p 244-249 refs (For availability see N74-17343 08-20)

Results of investigating the meridional transformations of the geopotential field and winter warmings in the stratosphere of the Northern Hemisphere are described. It is demonstrated that they are realized under the effect of tropospheric processes. It is shown that this effect is not limited to the lower stratosphere, but is extended up to 50-60 km altitudes. Author (ESRO)

N74-17356 McGill Univ., Montreal (Quebec). Marine Sciences Center.
ICE MOVEMENT IN THE GULF OF ST. LAWRENCE
E. R. Pounder, O. M. Johannessen, and B. D. Wright *In* WMO Energy Fluxes over Polar Surfaces 1973 p 250-280 refs (For availability see N74-17343 08-20)
(Contract DSS-7094000; Grant NRC-A-2669)

A study of ice drift was carried out in 1970 in the Gulf of St. Lawrence (Canada) using as a base an ice-strengthened vessel. Four buoys with radar reflectors, anemometers, and suspended current meters were placed on nearby floes. The vessel was allowed to freeze into a large floe and the vessel and buoys drifted for 27 days in a generally southerly direction. Routine observations were made (by Decca navigator and radar) of wind velocity at different heights and locations, and of currents at 6 levels. A total of 450 hydrocasts were made, using an STD (salinity, temperature, depth) recorder, together with a few Nansen casts for calibration of the STD instrument. Some results are presented on the relations between the wind and current fields and the movement of the ice. Author (ESRO)

N74-17357 Articheskii i Antarkticheskii Nauchno- Issledovatelskii Institut, Leningrad (USSR).
ELECTROMAGNETIC AND OPTIC CHARACTERISTICS OF SEA ICE
V. V. Bogorodsky, B. Y. Gaytskhoky, and V. I. Tripolnikov *In* WMO Energy Fluxes over Polar Surfaces 1973 p 281-299 refs (For availability see N74-17343 08-20)

Physical processes of ocean and atmospheric interaction under Arctic conditions depend on the state of the ice cover. Such factors as ice concentration, ice thickness, and elastic properties of ice exert influence on the mechanical aspects of the interaction; besides these factors the heat exchange is influenced by ice temperature, heat conductivity, spectral ice, and snow transparency. Remote methods of measurement of sea ice are discussed and as well as a photometric model of ice and snow-ice cover. Spectral values of the coefficients of diffuse transmission are shown. The described approach to the solution of the problem of optical radiation transfer through the snow-ice cover may give quite satisfactory results for a number of practical tasks. Author (ESRO)

N74-17358# Direction de la Meteorologie Nationale, Paris (France). Centre Meteorologique Regional de Marignane.
NORTH-WEST WINDS AND THE 'MISTRAL' AT MARSEILLE FROM 1882 TO 1970 (STATISTICAL TEST) [VENTS DE NORD-OUEST ET MISTRAL A MARSEILLE DE 1882 A 1970 (ESSAI STATISTIQUE)]
C. Bordreuil, A. Barbia, and P. Comte Sep. 1973 38 p refs In FRENCH
(Mono-88) Avail: NTIS HC $4.00

A statistical analysis was carried out using the data recorded from 1882 at Marseilles, France on northwest and northeast winds. The problem of northwest consecutive day series is discussed, as well as the characteristics of annual variations of northeast frequency at Marseilles. The methods are presented, and annual and seasonal variations of the northeast winds are analyzed. ESRO

N74-17359# World Meteorological Organization, Geneva (Switzerland). International Scientific and Management Group for GATE.
THE RADIATION SUB-PROGRAMME FOR THE GARP ATLANTIC TROPICAL EXPERIMENT
Helmut Kraus Oct. 1973 124 p refs Sponsored in part by Natl. Oceanic and Atmospheric Admin.
(Grants NSF GA-36302; NSF GA-18783)
(GATE-4) Avail: NTIS HC $8.25

Specific scientific objectives and the experimental methods to be used in the radiation subprogram of the Global Atlantic Tropical Experiment (GATE) are discussed. A specific experiment design is outlined. The objectives of the subprogram are to determine the vertical profiles of radiative fluxes in relation to principal parameters such as clouds and aerosols, and to determine the net radiation and its components at the ocean surface. Aircraft utilization as well as radiation instrument comparison methods are discussed in appendices. For individual titles, see N74-17360 through N74-17361.

N74-17360 World Meteorological Organization, Geneva (Switzerland).
AIRCRAFT UTILIZATION BY THE GATE RADIATION SUBPROGRAMME
M. R. Poellot, B. A. Albrecht, S. K. Cox, and R. Ellingson *In its* The Radiation Sub-programme for the GARP Atlantic Tropical Experiment Oct. 1973 p 79-84 refs (For availability see N74-17359 08-20)
(Grant NSF GA-36302)

Flight configurations and location requirements, as well as program goals and their implementation, are discussed for aircraft utilization in the GARP Atlantic Tropical Experiment. Types of aircraft measurements to be made include: flux divergence, atmospheric transmissivities, spectral and angular characteristics of surfaces, line integrals of upward and downward irradiance, and spectral irradiance with calculations. ESRO

N74-17361 World Meteorological Organization, Geneva (Switzerland).
RADIATION INSTRUMENTS AND COMPARISON METHODS
K. J. Hanson *In its* The Radiation Sub-programme for the GARP Atlantic Tropical Experiment Oct. 1973 p 96-104 refs (For availability see N74-17359 08-20)

Definitions and recommendations for standardization are given for radiation instruments to be used in the GARP Atlantic Tropical Experiment. Instruments include: pyrheliometers, pyranometers, pyrgeometers, and pyrradiometers. ESRO

N74-17362# Direction de la Meteorologie Nationale, Paris (France). Service Meteorologique de Polynesie Francaise.
CLIMATOLOGY OF THE AIRPORT OF TAHITI-FAAA [CLIMATOLOGIE DE L'AEROPORT DE TAHITI-FAAA]
G. Cauchard, R. Leymarie, J. Bacara, and R. Magniez Aug. 1973 61 p In FRENCH
(Mono-87) Avail: NTIS HC $5.25

Predominant meteorological conditions in Polynesia, are given, and the climatology of the Tahiti-FAAA airport is discussed. Meteorological parameters, including atmospheric pressure, air temperature, relative humidity, groundwind, precipitation, and cloudiness are tabulated. The phenomenon of the alize, a northeastern of southeastern wind, is discussed. ESRO

N74-17363# World Meteorological Organization, Geneva (Switzerland).
ANNOTATED BIBLIOGRAPHY ON PRECIPITATION MEASUREMENT INSTRUMENTS
J. C. Rodda, comp. 1973 299 p refs
(WMO-343; Rept-17) Avail: NTIS HC $18.00; WMO, Geneva

An annotated bibliography on precipitation measurement instruments is presented, containing 1575 citations from the 19th century to 1969. Subject areas considered include: history, bibliography, gage specifications, non-recording gages, ground level gages and lysimeters, vectopluviometers, maximum catch gages, self recording gages, rainfall recorders, trace recorders, and telemetering gages. Snow measurements, snow pressure pillows, special snow gages, snow distribution, gage shields, raingage errors (adhesion, color, evaporation, condensation, wind and exposure, height, splash, other considerations), record correction, aerodynamic gages and wind tunnel tests, gages used on ships, networks of gages, comparison of radar and gage measurements, miscellaneous. A subject index is provided. ESRO

N74-17364# World Meteorological Organization, Geneva (Switzerland).

COMPENDIUM OF METEOROLOGY. VOLUME 1, PART 1: DYNAMIC METEOROLOGY
Aksel Wiin-Nielsen, ed. 1973 344 p
(WMO-364-Vol-1-Pt-1) Avail: NTIS HC $20.25; WMO Geneva

A review of dynamic meteorology is presented. Equations of motion are formulated with regard to relevant forces and in various coordinate systems. Physical variables are introduced taking into consideration perfect gases and continuity. The prediction problem is stated in terms of a complete set of equations, and boundary and initial value problems in the quasistatic approximation. The static equilibrium of the atmosphere is dealt with and examples given. Consideration of pressure as vertical coordinate is discussed in relation to the form taken in such a system by the equations of motion, the continuity equation, and the thermodynamic equation. Problems of circulation, vorticity, divergence, and deformation are discussed with regard to Kelvin, Bjerknes, and Helmholtz theorems. ESRO

N74-17365# World Meteorological Organization, Geneva (Switzerland).
COMPENDIUM OF METEOROLOGY. VOLUME 1, PART 2: PHYSICAL METEOROLOGY
Aksel Wiin-Nielsen, ed. and B. J. Retallack 1973 220 p
(WMO-364-Vol-1-Pt-2) Avail: NTIS HC $14.00; WMO, Geneva

A review of physical meteorology is presented. The composition of the atmosphere, with emphasis on air pollution, weather, and climate, is covered. Solar radiation is discussed in terms of origin, distribution and depletion, together with cloud effects. Terrestrial radiation is similarly considered with empasis on radiation transfer, heating, or cooling. The mean heat balance is survey as applied to the earth troposphere system and radiation measurements from satellites. Thermodynamics of dry and moist air are considered essentially from a mathematical point of view with empasis on adiabatic processes. Hydrostatic equilibrium is discussed noting standard atmosphere, altimetry, and reduction of pressure to mean sea level. ESRO

N74-17366# Stockholm Univ. (Sweden). Inst. of Meteorology.
ON INITIALIZATION FOR MODELS USING SIGMA AS VERTICAL COORDINATE
Hilding Sundqvist Oct. 1973 17 p refs
(Grants SWEDSRC-G-2753-4; SWEDSRC-G-0223-058)
(DM-10) Avail: NTIS HC $4.00

The divergence equation is derived from the equations of motion with sigma (=p/p sub s), as vertical coordinate. A comparison of the order of magnitude of the terms is made with the aid of scale analysis. When the stream function for the non-divergent mass flow is introduced in the divergence equation, a consistent approximation to a balance equation results. In using sigma as vertical coordinate there is a need for interpolation of analyzed observations from p- to sigma-surfaces in the process of establishing initial fields for a forecast. By employing the balance equation, only temperature needs to be interpolated (method b). This procedure appears preferable to the alternative of balancing on p-surfaces by the conventional balance equation followed by an interpolation of both mass- and wind-fields (method a). A comparison was made between forecasts started from initial fields obtained by a and b. In case a, pronounced gravity oscillations are present at least during the first 8 to 12 hours while in case b such oscillations are hardly detectable at any time during the forecasts. Author (ESRO)

N74-17367# Calspan Corp., Buffalo, N.Y.
AN INVESTIGATION OF THE RELATIVE IMPORTANCE OF VAPOR DEPOSITION AND CONTACT NUCLEATION IN CLOUD SEEDING WITH AgI Final Report
Ulrich Katz and Roland J. Pilie Sep. 1973 31 p refs
(Contract DAHC04-72-C-0034)
(AD-770450; CALSPAN-CK-5182-M-1; AROD-10704-1-EN) Avail: NTIS CSCL 04/2

In order to determine the relative frequency of contact and deposition nucleation in AgI seeded supercooled clouds, laboratory experiments were carried out in which the supercooled cloud drops were tagged with insoluble fluorescent particles. Ice crystals resulting from seeding this cloud with AgI were examined microscopically to locate fluorescent particles. Presence of such a particle in the center of an ice crystal was interpreted as evidence that freezing of a drop through contact nucleation initiated crystal formation. Absence of a tracer particle from an ice crystal center was considered to be indicative of crystals formed by the vapor deposition mechanism. (Modified author abstract) GRA

N74-17368# Weather Wing (3rd), Offutt AFB, Nebr.
SELECTED THERMAL PARAMETERS AS PREDICTORS OF PRECIPITATION TYPE FOR OFFUTT AIR FORCE BASE NEBRASKA
Russell W. Reed 1 Nov. 1973 12 p refs
(AD-770037; Rept-3WW-TN-73-5) Avail: NTIS CSCL 04/2

Four individual thermal parameters and three combinations of two of these parameters from Omaha, NE, radiosonde data tapes are correlated with the type of precipitation that occurred at Offutt AFB, NE, within three hours of radiosonde time. Parameters tested are 700 mb temperature, 850 mb temperature, surface temperature, and 1000-500 mb thickness. The main criterion for the selection of these parameters was the availability of forecast values. Author (GRA)

N74-17369# Institute for Storm Research, Inc., Houston, Tex.
THE THEORETICAL STUDY OF .DIURNAL MOUNTAIN-VALLEY CIRCULATION Final Report, 1 Jul. 1970 - 31 Jul. 1973
Wen Tang 27 Sep. 1973 13 p
(Grant DA-ARO(D)-31-124-72-G178)
(AD-770542; ISR-1-11; AROD-9256-2-EN) Avail: NTIS CSCL 04/2

Theoretical models are developed, using both numerical and analytical approaches, to investigate the circulation including the upper air flow over a two-dimensional undulating mountain-valley terrain. The interaction between the prevailing flow and the thermally induced flow due to differential heating over a typical mountain-valley terrain is studied. The spatial distribution of various meteorological variables for various thermal surface conditions corresponding to different times in the day and different turbulent flow conditions, are sought. Since the ground temperature or eddy heat flux transport to and from the ground surface in a mountain-valley terrain is vital to the transient problem of the wind circulation, the determination of surface temperature from the complicated energy equation is also investigated. (Modified author abstract) GRA

N74-17370# RAND Corp., Santa Monica, Calif. 04/2
THE BLACK CLOUD EXPERIMENT
Anne B. Kahle and D. Deirmendjian Jul. 1973 32 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-770607; R-1263-ARPA) Avail: NTIS

The Rand version of the Mintz-Arakawa two-level general circulation model of the atmosphere was used to study effects of a 6.5% reduction in incoming solar radiation. Sixty days were simulated. The temperatures of both the atmosphere and the ground began dropping immediately, relative to a control experiment, and dropped fairly steadily, reaching an average decrease of about a degree centigrade at the end of sixty days. (Modified author abstract) GRA

N74-17371# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Directorate.
TIME SERIES ANALYSIS OF LOW LEVEL WIND PROFILES
Novella S. Billions 23 Jul. 1973 18 p refs
(DA Proj. 1M0-62111-D-125)
(AD-770379; RR-73-8) Avail: NTIS CSCL 04/2

Records of a special set of rawinsonde balloon observations at Bedford, Massachusetts, have been analyzed to an altitude of 10 km above the surface. Correlations of the wind profiles at the surface and the 1- and 2-km levels have been computed for this special set of hourly wind measurements. An analysis on the magnitude of the horizontal wind vector changes to 10 km was also performed. The results indicate persistence for the wind speed profile up to 24 hours with an exponential decrease although after eight hours the correlation can be considered as marginal. The correlation of the wind direction profile decreases more rapidly with increasing lag time. Beyond the 14-hour

period, the data apparently follow the variation of the large scale perturbations. (Modified author abstract) GRA

N74-17372# California Univ., Los Angeles. Dept. of Meteorology.
ANALYSIS OF THE RHYTHMIC VARIATION OF THE HADLEY CIRCULATION OVER THE PACIFIC DURING 1963 - 1967 Interim Technical Report, Sep. 1972 - Aug. 1973
Jacob A. B. Bjerknes Sep. 1973 38 p refs
(Contract N00014-69-A-0200-4044; NR Proj. 083-287)
(AD-770599) Avail: NTIS CSCL 04/2

During 1963-67 the mid-Pacific equatorial ocean exhibited a sequence of rhythmic changes of temperature of approximately two-year periodicity. The atmospheric Hadley Circulation responded with increased intensity when the equatorial waters were at their highest temperature. In the present paper the tropical rhythms are described in more detail with Canton Island aerological time series showing the thermal forcing from the ocean spreading upward to the upper troposphere. An additional study of the zonal component of upper winds at Canton Island, 2 deg 48 min S, Johnston Island 16 deg 45 min N and NANDI, Fiji Islands, 17 deg 45 min S, shows that maximum cyclonic zonal wind shear (and by implication maximum cyclonic vorticity) occur in the lower troposphere of the tropical belt of both hemispheres at the times of maximum equatorial sea temperature. (Modified author abstract) GRA

N74-17373# Ocean Data Systems, Inc., Rockville, Md.
EXTENDING THE COMPUTERIZED TYPHOON/TROPICAL STORM PREDICTION PROGRAM (TYFOON 72) TOWARD SEVEN DAYS Final Report
4 Sep. 1973 115 p refs
(Contract N66314-72-C-1750)
(AD-770207; ENVPREDRSCHFAC-Tech-Paper-1-73) Avail: NTIS CSCL 04/2

The objective of the research was to develop methods for improved prediction of the movement of tropical cyclones in the 3-7 day time scale; the improved system was to be based on the existing TYFOON and/or TYFOON 72 automated programs for producing predictions out to 3 days. The work was divided into 3 tasks: A survey of the 2 existing prediction models and the updating and extending of the analog historical file used by these programs in producing their predictions; to determine the value of large-scale patterns in the prediction of typhoon formation and in subsequent track prediction; to refine the typhoon analog predictive techniques (Modified author abstract) GRA

N74-17374# Air Force Weapons Lab., Kirtland AFB, N.Mex.
UNITED STATES AIR FORCE AIRCRAFT POLLUTION EMISSIONS Final Report, 1 Jan. - 13 Jul. 1973
Dennis F. Naugle and Bernard T. Delaney Nov. 1973 51 p refs
(AD-769482; AFWL-TR-73-199) Avail: NTIS CSCL 13/2

The interest in pollution emissions from aircraft has been enhanced by Environmental Protection Agency's recent determination that major civilian airports are significant contributors to localized air-quality degradation. This report summarizes the USAF aircraft and engines in common use, presents normalized engine pollution emission factors (emission indices), reviews deficiencies in present emission data, and recommends future efforts to better analyze aircraft emissions. Primary goals of impact assessments at many locations and to stimulate comment on the direction of future USAF efforts concerning the recommended projects. Author (GRA)

N74-17375*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FATE AND EFFECTS OF OIL POLLUTANTS IN EXTREMELY COLD MARINE ENVIRONMENTS Final Report, May - Oct. 1973
Ronald M. Atlas 1 Nov. 1973 39 p refs
(Contracts NAS7-100; NAonr-30-73)
(NASA-CR-136851; AD-769895) Avail: NTIS HC $5.00 CSCL 13B

The discovery and plans for the use of Alaskas north slope petroleum fields has raised the question of what effects any accidental spillages would have on the indigenous biological populations and what the fate of the oil itself would be. Therefore, field studies were carried out to assess the interactions of microorganisms and prudhoe crude oil in Alaskan coastal waters. The main study site was located at Prudhoe Bay in Arctic Alaska. Some work was done at Valdez, the proposed southern terminus for the trans- Alaskan pipeline. Other experiments were conducted at Umiat and Cape Simpson where there are large natural oil seepages. Modified author abstract. GRA

N74-17376# Office of Naval Research, London (England).
ATMOSPHERIC POLLUTION BY AIRCRAFT ENGINES
A. M. Mellor (Purdue Univ.) and Ralph Roberts 1 Aug. 1973 23 p
(AD-769655; ONRL-C-17-73) Avail: NTIS CSCL 13/2

The report summarizes papers delivered at a meeting on the effect of chemical air pollution by aircraft at very high altitudes and near airports. Also discussed are engineering techniques for reducing pollutant production in combustion in aircraft engines. Both the problems of pollution generation as well as diffusion were discussed. (Modified author abstract) GRA

N74-17377# Transportation Systems Center, Cambridge, Mass.
US COAST GUARD POLLUTION ABATEMENT PROGRAM: A PRELIMINARY REPORT ON THE EMISSIONS TESTING OF BOAT DIESEL ENGINES Interim Report
Robert A. Walter Nov. 1973 41 p refs
(AD-769455; TSC-USCG-73-2; USCG-D-21-74) Avail: NTIS CSCL 13/2

The exhaust emission concentrations from three GM6-71's and a Cummins VT-350 diesel engines were measured on a dynamometer as a function of engine load. The GM6-71 engines were newly rebuilt by the Coast Guard; The Cummings Engine was in used condition. These engines are used as main power units in Coast Guard boats. The exhaust emission concentrations were reduced to mass emissions by the carbon balance technique. Similar emission levels were obtained from the three rebuilt GM6-71 engines with type HV injectors. Author (GRA)

N74-17378# Earth Satellite Corp., Washington, D.C.
THE NIMBUS 5 ESMR ELECTRICALLY SCANNED MICROWAVE RADIOMETER AND ITS APPLICATION TO STORM DETECTION Final Report, 14 May 1972 - 14 Jul. 1973
Romeo R. Sabatini and Earl S. Merritt Jul. 1973 54 p refs
(Contract N62306-72-C-0153)
(AD-770208; EPRF-51-0873-004) Avail: NTIS CSCL 04/2

Nimbus 5 ESMR computer programs developed by NADA have been modified to run on an IBM 360/65 computer and to accept the format of the Nimbus 5 Stacked Experiment Tape (SET) provided by NASA to the Environmental Prediction Facility. The various ESMR programs available are briefly described and sample ESMR brightness temperature (T(B)) map outputs are presented. The microwave properties of the atmosphere are briefly reviewed. A Nimbus 5 ESMR brightness temperature map of a storm area off the Florida coast on 12 January 1973 is compared with concurrent radar observations. A 5 level atmospheric model was used to calculate atmospheric brightness temperatures under conditions similar to observations. Differences between observed and calculated T(B)'s are explained in terms of inaccurate description of actual atmospheric conditions and the coarseness of our atmospheric model. (Modified author abstract) GRA

N74-17379# Defense Documentation Center, Alexandria, Va.
ENVIRONMENTAL POLLUTION: AIR POLLUTION-PARTICULATE MATTER Report Bibliography, Jan. 1971 - Jul. 1973
Nov. 1973 139 p refs
(AD-769960; DDC-TAS-73-71) Avail: NTIS CSCL 13/2

The bibliography is comprised of 88 citations of unclassified reports dealing with air pollution particulate matter in a series of bibliographies on environmental pollution. Some of the topics included are: analysis of atmospheric aerosols and particulate matter; specifically particle size, measurement, distribution, and identification of pollutants; the atmospheric motion of aerosol particles such as scattering, settling, diffusion, and transport properties, and other topics such as dust and pollens. Corporate

Author/Monitoring Agency, Subject, Title, Personal Author, Contract, and Report Number Indexes are included.
Author (GRA)

N74-17380# Army Foreign Science and Technology Center, Charlottesville, Va.
PRELIMINARY DATA ON ADIABATIC FOGS IN A LARGE AEROSOL CHAMBER
O. A. Volkovitskii, L. I. Yermoshina, and L. N. Pavlova 9 Nov. 1973 13 p refs Transl. into ENGLISH from Tr. Inst. Prikl. Geofiz. (Leningrad), no. 7, 1967 p 49-58
(AD-770722; FSTC-HT-23-1852-72) Avail: NTIS CSCL 04/2

Preliminary results are given from experiments in creating a fog in an aerosol chamber during an adiabatic expansion of the air. Change in transparency and microstructure of the fog within the chamber as it is dissipated has shown the fog is not uniform at various heights in the chamber. Studies of recurrence of fogs have shown that in two consecutive experiments carried out at identical initial conditions, the time required for dissipation of the fog is almost identical. The longest period of existence of a fog in the chamber is about 1.5 hours. GRA

N74-17381# Army Foreign Science and Technology Center, Charlottesville, Va.
THE CHARACTERISTICS AND GEOGRAPHICAL DISTRIBUTION OF DUST STORMS
P. S. Zakharov 16 Apr. 1973 6 p refs Transl. into ENGLISH from the publ. "Meteorologiya, Klimatologiya i Gidrologiya Mezhvedomstvennyi Nauchnyi Sbornik" Kiev, 1966 p 19-23
(AD-770736; FSTC-HT-23-1131-73) Avail: NTIS CSCL 04/2

Dust storms are defined and the damage caused by them is discussed. Statistics on the frequency of occurrence of dust storms in the U.S.S.R. are given. (Modified author abstract)
GRA

N74-16766* Alaska Univ., Fairbanks.
SURFACE WIND CHARACTERISTICS OF SOME ALEUTIAN ISLANDS
Tunis Wentink, Jr. *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 46-52 refs (For availability see N74-16757 08-03)
CSCL 04B

N74-16768* Electrical Research Association, Surrey (England).
WIND DATA FOR WIND DRIVEN PLANT
Arthur H. Stodhart *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 62-69 (For availability see N74-16757 08-03)
CSCL 04B

N74-16797* AeroVironment, Inc., Pasadena, Calif.
WIND MACHINES
P. B. S. Lissaman *In* NASA. Lewis Res. Center Wind Energy Conversion Systems Dec. 1973 p 208-239 (For availability see N74-16757 08-03)
CSCL 04B

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-17382 Purdue Univ., Lafayette, Ind.
THE DESIGN OF A PILOT AUGMENTED LANDING APPROACH CONTROL SYSTEM Ph.D. Thesis
Thomas Browning Cunningham 1973 225 p
Avail: Univ. Microfilms Order No. 73-28064

The possibility of highly complex and demanding maneuvers during an aircraft landing approach has been fostered by the microwave landing guidance system. The problem is considered of optimally quantifying commands given through a visual display which would allow a human pilot to control an aircraft along a given approach path subject to moderate turbulence and initial position errors. The performance index is the expected value of a weighted integral quadratic sum of state variables and control variables. The design is a closed loop system which sends an optimal sum of aircraft and pilot states to the display command. It takes into account the pilot's response limitations and makes use of pilot model parameter values which have been shown to evoke good pilot evaluations in a control task. The system model contains all component subsystems which it is felt will affect the design. These include the aircraft, pilot, and control dynamic models. Dissert. Abstr.

N74-17383 California Univ., Los Angeles.
IDENTIFICATION AND STOCHASTIC CONTROL WITH APPLICATION TO FLIGHT CONTROL IN TURBULENCE Ph.D. Thesis
Kenneth Warren Iliff 1973 257 p
Avail: Univ. Microfilms Order No. 73-28715

The problem is dealt with of adaptive control of an aircraft in atmospheric turbulence. The problem is approached by first identifying the unknown coefficients and then applying optimal control theory to the system so determined. The theory developed is general enough to apply to any linear system with unknown coefficients and state noise. The bulk of the development concerns the identification problem and several methods are studied. In particular, what may be called stochastic identification method, taking into account the unknown state noise, is studied. The identification and control theory is first verified on simulated data. It is shown that the methods that accounted for the state noise are adequate where the assumptions hold. The optimal control results agree well with theory in achieving the desired minimization. Dissert. Abstr.

N74-17384*# TRW Systems Group, Redondo Beach, Calif.
FEASIBILITY TEST FOR A V-SLIT STAR MAPPER FOR PIONEER SPACECRAFT TERMINAL NAVIGATION Final Report
R. F. Gates, J. V. Flannery, and J. T. Cragin Nov. 1973 123 p refs
(Contract NAS2-7597)
(NASA-CR-114734; R-7537-2-451) Avail: NTIS HC $9.25

A laboratory demonstration of the feasibility of using a V-slit star mapper to meet the sensitivity and accuracy of on-board navigational requirements for future Pioneer Missions to the outer planets was conducted by the Control and Sensors Laboratory of TRW. The breadboard was extremely simple in configuration, consisting of an end-on photomultiplier tube and a V-slit reticle located at the focal plane of the objective lens. In addition, a plano-convex lens was used between the reticle and the PMT in a Fabry-Perot configuration. The analytical effort indicated that the sensor should easily meet the requirements. The Pioneer SRA test set was examined to determine its basic accuracy and modify it where necessary to bring its accuracy into the 1-3 arc second range. The test results show that it is feasible to use this type of star mapper in the 10 arc second accuracy range. The test equipment accuracy (approximately 5 arc Sec) was sufficient to bound the sensor errors at less than 10 arc seconds. Author

N74-17385*# Drexel Univ., Philadelphia, Pa.
DEVELOPMENT OF VISUAL-DISPLAY AID TO AIR NAVIGATION Final Report, 1 Jan. 1972 - 31 Mar. 1973
T. J. Matcovich Apr. 1973 62 p refs
(Grant NGR-39-004-038)
(NASA-CR-132412) Avail: NTIS HC $3.75 CSCL 17G

The developments are discussed in the design of a liquid-crystal, visual display, air navigation aid, which uses two VOR signals to locate the aircraft. The system concepts, liquid crystal materials, stability tests, and the electronic system are described. It is concluded that a navigational aid of this type is technically feasible, but not at the projected low cost. F.O.S.

N74-17386# Naval Weapons Center, China Lake, Calif.
PENDULUM DAMPER FOR FREE GYRO SEEKER
William R. Haseltine Oct. 1973 37 p refs
(AD-770126; NWC-TP-5547) Avail: NTIS CSCL 17/7

A theoretical and modeling study is made of the applicability of pendulum-type nutation dampers to free-gyro target seekers. It is concluded that such dampers can be very useful, and some guidelines for detailed system design are derived and presented.
Author (GRA)

N74-17387# Naval Weapons Lab., Dahlgren, Va.
INERTIAL NAVIGATION UTILIZING SATELLITE RANGE AND DOPPLER OBSERVATIONS
Patrick James Fell Jun. 1973 49 p refs
(AD-770559; NWL-TR-2975) Avail: NTIS CSCL 17/7

The application of linear estimation theory for the improvement of inertial navigation system estimates of aircraft position and velocity is described. The technique uses satellite range and range rate (Doppler) observations and vehicle borne altimeter measurements for the correction of inertial navigation system outputs and for the estimation of various other quantities such as frequency bias. Satellite orbit uncertainty is introduced into the solution through the mean anomaly uncertainty in each observed satellite's computed orbit. A specific example is given which uses observations from two satellites. Author (GRA)

N74-17388# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
DETERMINATION OF FRAGILITY VALUES FOR THE LN-12 INERTIAL GUIDANCE PLATFORM AND ASSOCIATED G-200 GYROSCOPE
Matthew A. Venetos Oct. 1973 32 p
(AFPEA Proj. 73-P7-124)
(AD-769908; DSPT-73-55) Avail: NTIS CSCL 17/7

Fragility values for Air Force weapon system components, i.e., the LN-12 inertial guidance platforms and the G-200 gyroscope, were determined. The damage boundary concept method of determining item fragility was employed. Essentially, this method involves subjecting the item to rectangular waveform pulses of increasing amplitude but constant velocity change. Both structural mechanical damage and deviations in electrical measurement values were used to define item failure points. The results of this study revealed that the actual item fragility values obtained using the damage boundary concept method were appreciably higher than the ratings specified for the items by the manufacturer. Author (GRA)

N74-17389# Air Force Academy, Colo. Frank J. Seiler Research Lab.
SEISMIC ANGULAR MOTION SENSOR
Shigeo Kubo Aug. 1973 14 p refs Presented at the AIAA Guidance and Control Conf., Key Biscayne, Fla., 20-22 Aug. 1973
(AF Proj. 7904)
(AD-769288; SRL-TR-73-0011; AIAA-Paper-73-829) Avail: NTIS CSCL 17/7

The design, fabrication and evaluation of a fused silica, balanced rotor, angular motion sensor which is insensitive to linear accelerations is described. A mathematical model was developed which defines the physical parameters that could be controlled during assembly and test. The design parameters include rotor moment of inertia, torsional spring constant, and magnetic damping. An independent optical pickoff system was developed using a solid state light source and two matched photo cell detectors. Extensive testing was accomplished on the subassemblies as well as the completed sensor. Test results indicate a performance sensitivity of about 0.01 arc second with a linear range of nearly two degrees. Comparison tests between two prototype sensors indicate an excellent response to low level angular inputs in the .1 to 100 Hz frequency region. This pilot development effort of an angular motion sensor indicates that an extremely sensitive device can be fabricated from quartz which will provide broadband measurements for a wide range of critical applications. Author (GRA)

N74-17390# Aerospace Systems, Inc., Burlington, Mass.
NORTH ATLANTIC (NAT) AIDED INERTIAL NAVIGATION SYSTEM SIMULATION. VOLUME 1: TECHNICAL RESULTS Final Report, Jun. 1972 - Jan. 1973
William C. Hoffman, Walter M. Hollister, and Kenneth R. Britting Jul. 1973 197 p refs
(Contract DOT-TSC-473)
(AD-770072; FAA-RD-73-112-Vol-1; FAA-RD-73-23-Vol-1) Avail: NTIS CSCL 17/7

Current air traffic operations over the North ATlantic (NAT) and the application of hybrid navigation systems to obtain more accurate performance on these NAT routes are reviewed. A digital computer simulation program (NATNAV - North ATlantic NAVigation) is developed to evaluate the performance of navigation systems for future commercial NAT aircraft operations. Error models are developed for aided-inertial navigation systems with external measurements from Doppler radar, Omega, satellite-ranging or air data. (Modified author abstract) GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-17391*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER STUDY OF EMERGENCY SHUTDOWNS OF A 60-KILOWATT REACTOR BRAYTON SPACE POWER SYSTEM
Roy C. Tew and Kent S. Jefferies Washington Feb. 1974 32 p refs
(NASA-TM-X-2979; E-7651) Avail: NTIS HC $3.00 CSCL 18I

A digital computer study of emergency shutdowns of a 60-kWe reactor Brayton power system was conducted. Malfunctions considered were (1) loss of reactor coolant flow, (2) loss of Brayton system gas flow, (3)turbine overspeed, and (4) a reactivity insertion error. Loss of reactor coolant flow was the most serious malfunction for the reactor. Methods for moderating the reactor transients due to this malfunction are considered. Author

N74-17392# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
METALLURGY AND THERMODYNAMICS OF A CARBIDE FUEL CONTAINING INACTIVE FISSION PRODUCTS: SIMULATION OF IRRADIATED NUCLEAR FUEL Ph.D. Thesis - Paris Univ., Orsay
N. Lorenzelli Jul. 1973 126 p refs In FRENCH
(CEA-R-4465) Avail: AEC Depository Libraries HC $8.50

A simulated fuel, either partially or totally, is examined without or with volatile F.P. The fabrication process is described, as the metallurgy and the thermodynamic properties of these materials, with emphasis on the parameter variation of the lattice and on the existence of the various phases to be formed. Three irradiation burnup effect were simulated: 70,000; 100,000; and 150,000 MWd/t (U + Pu). An analysis was performed on the chemical behavior of the fuel during irradiation, in presence of the stainless steel cladding. Several conclusions of technologicl interest could be derived, in particular, the noncarburizing character of the fission process. Finally, some irradiation results are discussed. Author (NSA)

N74-17393# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY AND SET UP OF AN EXPERIMENTAL SYSTEM, FOR MEASURING CONCENTRATION PROFILES, USING NUCLEAR REACTIONS ANALYSIS AND SPUTTERING EFFECT: APPLICATIONS Ph.D. Thesis - Univ. Sci. et Med. de Grenoble
M. Bruel Sep. 1973 157 p refs In FRENCH
(CEA-R-4480) Avail: AEC Depository Libraries HC $10.00

Nuclear reactions analysis may provide the spatial distribution of an impurity within a substrate. An experimental system was set up which provides the depth-distribution of the analyzed element (concentration profile), through the association of the nuclear reactions analysis and the sputtering phenomenon. The method consists in alternating the two proceedings: analysis and surface etching. The vacuum problems in the target chamber and ion gun, the characteristics of the ion source were studied. The method was applied to determining concentration profiles of boron, phosphorus and oxygen in metals, semiconductors and insulating layers. Author (NSA)

N74-17394# Los Alamos Scientific Lab., N.Mex.
MEASUREMENTS OF HELIUM RELEASE FROM MATERI-

ALS CONTAINING (Pu-238)O2
R. N. R. Mulford and B. A. Mueller Jul. 1973 11 p refs
(Contract W-7405-eng-36)
(LA-5215) Avail: NTIS HC $4.00

Measurements of the isothermal helium release rates as a function of time for five materials containing 80% pu-238 are described. The materials were plasma-torch microspheres, and cylindrical 1/4- by 1/4-in. pellets of PuO2, PuO2-56 wt % ThO2, PuO2-7 wt % XrO2, and PuO2-35 wt % ZrO2. Attempts to fit the data with a classical diffusion model, and the deviations therefrom, are discussed. Author (NSA)

N74-17395# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY ISOTOPIC POWER FUELS PROGRAMS, APRIL - JUNE 1973
7 Sep. 1973 57 p refs
(Contract AT(33-1)-GEN-53)
(MLM-2080) Avail: NTIS HC $5.45

Progress in the isotopic fuels program during Apr. to July 1973 is reported. Preparation and process studies of pu-238 fuels continued. Sufficient fuel was processed to fabricate two Viking capsules containing a total of 1364.21 W of plutonium-238. Seventeen pressed plutonium oxide spheres were fabricated as part of the MHW fuel development effort. Six spheres were used for substoichiometric studies. Vacuum reduction of PuO2 MHW fuel was considered. The degree of high temperature vacuum reduction of Pu-23802 MHW fuel spheres was experimentally determined over the 1400 to 1800 C range. The one hour 1400 C treatment did not result in a measurable change in the O/Pu ratio. To obtain reductions on the order of O/Pu greater than or equals is 1.98, temperatures of 1700 to 1800 C for 1 h were necessary. NSA

N74-17396# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SYNTHETIC SLOWING-DOWN MODELS AND THE C SUB N METHOD: APPLICATIONS TO FAST NEUTRON EXPONENTIAL EXPERIMENTS Ph.D. Thesis - Paris Univ., Orsay
H. Lorain Jun. 1973 262 p refs In FRENCH
(CEA-N-1604) Avail: AEC Depository Libraries HC $15.25

The fast neutron exponential experiments can only be interpreted using transport theory, since the space and energy transients are of great importance. A numerical solution based on a lemma of G. Placzek is presented. This theorem allows the flux in a finite medium to be calculated by calculating the flux in the same medium extended over the whole of space by the introduction of surface boundary sources in the medium. These sources are used to solve an integral equation whose kernel is the Green's function of the infinite medium. After the Fourier transform is performed, it is shown, using several synthetic slowing-down models, that these Green functions can be found analytically. Fission rates are calculated for various detectors, and a linear combination of the different rates is given in order to minimize the boundary effect. Evidence is given showing the importance of the neutrons coming directly from the source (reactor). NSA

N74-17397# Oak Ridge Y-12 Plant, Tenn.
NERVA FUEL ELEMENT DEVELOPMENT PROGRAM. PART 1: EXTRUSION STUDIES Summary Report, Jul. 1966 - Jun. 1972
J. M. Napier, ed. 21 Sep. 1973 119 p refs
(Contract W-7405-eng-26)
(Y-1852-Pt-1) Avail: NTIS HC $5.45

Collected data on NERVA extruded graphite fuel elements are presented. The physical properties of the fuel element reached the following values: coefficient of thermal expansion (CTE): 7.0 x minus 1 million/C at 25 to 1000 C; modulus of elasticity; 1/5 x 1 million psi; flexural strength: approximately 8000 psi; ultimate strain to failure: 5500 micro in/in; and good thermal stress resistance. Matrices were produced which could be vapor coated with crack-free films of zirconium carbide. The CTE of the matrix was almost equal to the CTE of the zirconium carbide coating. Author (NSA)

N74-17398# Oak Ridge Y-12 Plant, Tenn.
NERVA FUEL ELEMENT DEVELOPMENT PROGRAM. PART 2: IMPREGNATION STUDIES Summary Report, Jul. 1966 - Jun. 1972
J. M. Napier, comp. 21 Sep. 1973 60 p refs
(Y-1852-Pt-2) Avail: NTIS HC $5.45

Various types of graphites were manufactured during the NERVA fuel element development program to obtain data on the effects of fillers and binders, and to characterize the physical properties of a variety of graphites. These graphites ranged structurally from near isotropic to anisotropic. Two methods were employed to densify graphite bodies: gaseous impregnation and liquid impregnation. Gaseous impregnation consisted of two processes: direct flow and pulse vacuum. Liquid impregnation was based on the use of a polymer of cinnamylideneindene. Both types of gaseous impregnation processes were successful in densifying the fuel element graphites; however, the process time of the pulse vacuum method was shown to be signficantly shorter than that of the direct flow process. The liquid impregnation process was also successful. Two to four impregnation cycles were required to obtain a maximum density. Author (NSA)

N74-17399# Oak Ridge Y-12 Plant, Tenn.
NERVA FUEL ELEMENT DEVELOPMENT PROGRAM. PART 3: CHARACTERIZATION OF VAPOR-DEPOSITED NIOBIUM AND ZIRCONIUM CARBIDES Summary Report, Jul. 1966 - Jun. 1972
A. J. Caputo, comp. 21 Sep. 1973 47 p refs
(Contract W-7405-eng-26)
(Y-1852-Pt-3) Avail: NTIS HC $4.00

Chemical and physical properties of vapor deposited niobium carbide and zirconium carbide have been determined by the fabrication of thick wall tubes of each carbide under varying deposition conditions. The effects studied included coefficient of thermal expansion, density, impurity level, carbon-to-metal ratio, and metallographic structure. Some of the zirconium carbide coatings contained four percent oxygen and chlorine, and the impure coatings were unstable when heated above the deposition temperature of 1100 C. The amount of instability was primarily related to the oxygen and chlorine content; an increased deposition temperature reduced the impurity contents to less than 500 ppM. The higher temperature process conditions produced coatings with a predictable and consistent coefficient of thermal expansion value which could be repeatedly heated to 2000 C without any detrimental effects such as weight and volume changes. Author (NSA)

N74-17400# Oak Ridge Y-12 Plant, Tenn.
NERVA FUEL ELEMENT DEVELOPMENT PROGRAM. PART 4: VAPOR DEPOSITION OF METAL CARBIDES Summary Report, Jul. 1966 - Jun. 1972
A. J. Caputo, comp. 21 Sep. 1973 58 p refs
(Contract W-7405-eng-26)
(Y-1852-Pt-4) Avail: NTIS HC $5.45

Vapor deposition processes for coating NERVA graphite fuel elements have been completed. This effort included the deposition of: (1) niobium carbide at 1700 to 2000 C; (2) niobium carbide at 1000 to 1300 C; (3) zirconium carbide at 1000 to 1400 C; and (4) niobium carbide plus zirconium carbide at 1000 to 1250 C. Various properties (e.g. coefficient of thermal expansion, density, crystal structure, and impurities) of each were determined in order to characterize each coating or combination of coatings. Author (NSA)

N74-17401# Oak Ridge Y-12 Plant, Tenn.
NERVA FUEL ELEMENT DEVELOPMENT PROGRAM. PART 5: ION EXCHANGE RESIN FUEL BEADS Summary Report, Jul. 1966 - Jun. 1972
F. E. Clark, comp. 21 Sep. 1973 51 p refs
(Contract W-7405-eng-26)
(Y-1852-Pt-5) Avail: NTIS HC $5.45

For some years, the standard fuel for NERVA reactors had been commercially available, spherical particles of uranium dicarbide encapsulated in a shell of pyrocarbon. The fuel particles were incorporated into a fuel element formed by extruding a blend of graphite powder, fuel particles, and binder. The extruded shape was then heat treated up to 2200 C to carbonize the binder. The NEVA rocket had a maximum temperature capability, which was partially due to the thermal stability of the fuel particles.

It was desirable to obtain fuel particles that could be heated to temperatures in excess of 2400 C without loss of the uranium to the fuel element matrix. Fuel particles, made by adding uranium to commercially available ion exchange resins, have been demonstrated to be stable at temperatures greater than 2400 C. Utilization of these types of particles for NERVA applications was not completed by the time the program was terminated.
Author (NSA)

N74-17402# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
[RESEARCH ON SOLIDS, SPACE POWER, REACTORS, THERMONUCLEAR ACTIVITY AND TRANSURANIUM] Annual Progress Report, period ending 30 Jun. 1973
S. Peterson Oct. 1973 123 p refs
(Contract W-7405-eng-26)
(ORNL-4870) Avail: NTIS HC $5.45

Research is reported in the following areas: fundamental programs (crystals, deformation, diffusion, electron microscopy, ceramics, physical metallurgy, physical properties, superconductors, surface phenomena, theoretical research, X-ray diffraction); space power technology (high-temperature alloys for isotopic heat sources Cm-244 compatibility testing, iridium fabrication, physical metallurgy of heat-source containment materials, tungsten metallurgy); reactor development support (gas-cooled reactor, heavy section steel technology, military reactor fuel element procurement, molten-salt reactor, thorium utilization, research reactor materials); controlled thermonuclear research; transuranium program; biomaterials, graphite fabrication; metallography; and Auger electron spectroscopy. NSA

N74-17403# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
PARAMETRIC STUDY OF THE COLLOID REACTOR ROCKET ENGINE. COMPUTER PROGRAM FOR PREDICTING COLLOID CORE FUEL VAPORIZATION LOSS RATES
Sep. 1973 72 p refs
(Contract F33615-72-C-1197; AF Proj. 7116)
(AD-770109; WANL-PR-006; ARL-73-0220) Avail: NTIS CSCL 21/6

A parametric study was performed of the Colloid Core Reactor Rocket Engine. This report describes the computer program written to calculate fuel vaporization loss rates in the Colloid Core Reactor. The theoretical development of the model and the organization of the program are comprehensively dicussed. Input instructions and a complete listing of the code are provided. A sample problem is used to illustrate and to define the output data. (Modified author abstract) GRA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-17404 Illinois Univ., Chicago.
THE ANALYSIS OF RADIATIVE TRANSFER IN STRATIFIED MEDIA USING FUNDAMENTAL SOURCE FUNCTIONS Ph.D. Thesis
Henry Michael Domanus 1973 109 p
Avail: Univ. Microfilms Order No. 73-26564

An important problem in radiative transfer is finding the radiative fields caused by various illuminations within a plane-parallel, stratified, absorbing, emitting and anisotropically scattering finite medium. A Green's function, called the fundamental source function, is used to analyze this problem. This function separates optical properties of the medium from the illumination. The linearity of radiative transfer is then used to represent all possible source functions as convolutions of the illumination with the fundamental source function. Including internal sources in this work allows certain reciprocity relations to be proved that lead to a unification of probability functions and the source functions. In the limit, when the medium is assumed nonemitting, the representation becomes identical to the well known standard source function discussed by other researchers. Parametric differentiation is used to map out a numerical procedure for obtaining the fundamental source function. Dissert. Abstr.

N74-17405*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JET NOISE FROM CO-AXIAL NOZZLES OVER A WIDE RANGE OF GEOMETRIC AND FLOW PARAMETERS
W. Olsen and R. Friedman 1974 30 p refs Presented at 12th Aerospace Sci. Meeting, Washington, D. C., 30 Jan. - 1 Feb. 1974; sponsored by AIAA
(NASA-TM-X-71503; E-7873) Avail: NTIS HC $3.50 CSCL 20A

Free field pure jet noise data were taken for a large range of coaxial nozzle configurations. The core nozzles were circular (1 to 4 in. diameter) and plug types. The fan to core area ratio varied from 0.7 to 43.5, while the velocity ratio typically varied from 0 to 1. For most cases the two nozzles were coplanar but large axial extensions of either nozzle were also tested. Correlation of the data resulted in a simple procedure for estimating ambient temperature subsonic coaxial jet noise spectra over a wide range of geometric and flow parameters. Author

N74-17406*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADVANCED ELECTRO-OPTICAL IMAGING TECHNIQUES
Stanley Sobieski, ed. and E. Joseph Wampler, ed. (Lick Obs.) Washington 1973 134 p refs Symp. held at Washington, D. C., 22 Sep. 1972
(NASA-SP-338; LC-73-600316) Avail: NTIS HC $4.75 CSCL 20F

The papers presented at the symposium are given which deal with the present state of sensors, as may be applicable to the Large Space Telescope (LST) program. Several aspects of sensors are covered including a discussion of the properties of photocathodes and the operational imaging camera tubes. For individual titles, see N74-17407 through N74-17414.

N74-17407* Bendix Research Labs., Southfield, Mich.
DESIGN OF PHOTOELECTRONIC OPTICAL IMAGE SENSORS
C. B. Johnson *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 5-20 (For availability see N74-17406 08-23)
CSCL 20F

The main performance goals for the image sensors are given and the design criteria for accomplishing these goals are discussed. Each functional element of the image sensors is described along with the various tradeoffs considered. D.L.G.

N74-17408* Stanford Univ., Calif.
PHOTOCATHODES FOR USE IN THE LARGE SPACE TELESCOPE PROGRAM c09
W. E. Spicer *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 21-34 ref (For availability see N74-17406 08-23)
CSCL 09A

Photocathode materials are discussed in terms of those that are presently available and those that are becoming available. Charts are given which illustrate the response curves of the representative photocathodes. It can be seen from the curves that a relatively new class of photocathodes has been developed with responses equal to or much better than commercially available photocathodes over a very wide spectral range. In particular, the solid gallium arsenide photocathode has an increased efficiency over the standard S-1 in the infrared region of almost two orders of magnitude. A table is presented which describes the principle photocathodes and lists some of the important characteristics of each. D.L.G.

N74-17409* Radio Corp. of America, Lancaster, Pa.
ELECTRON-OPTIC LIMITATIONS ON IMAGE RESOLUTION
R. W. Engstrom *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 35-50 refs (For availability see N74-17406 08-23)
CSCL 20F

Various approaches are considered to the solution of the electron-optical problem of designing an image tube configuration.

Emphasis is placed on the method of computer design, and an illustration is given in which the technique is used in the design of an 80-mm image tube with a zoom capability of 3:1. The solutions are discussed to such problems as image distortion, magnification, and electron bundles striking the zoom electrode. Three types of an electron-optical configuration are examined for the electron-optic limitations to resolution: (1) the proximity image tube, (2) the magnetic-type image tube having uniform electric and magnetic fields, and (3) the electrostatic-type image tube such as the 80-mm zoom tube. D.L.G.

N74-17410* Bell Telephone Labs., Inc., Holmdel, N.J.
IMAGE RECORDING USING CHARGE-COUPLED DEVICES c26
C. Sequin *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 51-68 refs (For availability see N74-17406 08-23)
CSCL 20L

The principle of charge coupling is reviewed and some performance limitations are discussed. The practicality of a two-dimensional charge-coupled area-imaging device is examined. Of several possible design approaches, a frame transfer approach was chosen for detailed consideration because it has a very simple resolution cell. The results obtained in utilizing the proposed approach are given along with some of the problems detected. Author

N74-17411* CBS Labs., Stamford, Conn.
THE ELECTROSTATIC STORAGE TUBE c09
R. E. Rutherford, Jr. *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 69-80 (For availability see N74-17406 08-23)
CSCL 09A

An electrostatic camera system is discussed which is based on the electrostatic storage tube. The development of the system was begun following a series of experiments which indicated that the device offers signficantly improved performance over currently available devices. The approach used in developing the high performance camera involves: converting the input image to an electron image at low loss, applying a low noise gain process, and storing the resulting charge pattern in a low-loss target. The basic processes and elements of the electrostatic storage tube are illustrated and discussed. Graphs that depict the camera performance characteristics are included. D.L.G.

N74-17412* Princeton Univ. Observatory, N.J.
LARGE SPACE TELESCOPE TELEVISION SENSOR DEVELOPMENT c14
J. L. Lowrance *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 81-92 (For availability see N74-17406 08-23)
CSCL 20F

Studies conducted towards the development of space astronomy television sensors are reported. The SEC vidicon tubes being utilized in the development effort are described. The operational characteristics of these tubes are given in tables and charts together with discussions of their significance. D.L.G.

N74-17413* California Inst. of Tech., Pasadena.
APPLICATION OF SILICON IMAGE TUBES (SIVIT AND SIT) TO GROUND-BASED ASTRONOMY c09
J. A. Westphal *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 93-106 (For availability see N74-17406 08-23)
CSCL 09A

Studies conducted with ordinary silicon target tubes (SIVIT) and with silicon intensified tubes (SIT) are described. The operational characteristics of each type are given along with the advantages and disadvantages in various applications. D.L.G.

N74-17414* California Univ., San Diego.
DIGITAL MULTICHANNEL PHOTOMETRY WITH DIGICONS c14
C. E. McIlwain *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 107-123 refs (For availability see N74-17406 08-23)
CSCL 14B

The digital system is described and compared to other sensor systems. The digicon system starts with a photocathode, has magnetic focusing of the accelerated photoelectrons, and the electrons hit an array of solid-state diodes. These characteristics, however, are the only ones which are applicable to both the digicon and the other systems. With the digicon system, instead of attempting to read the resulting charges on the diodes by probing electrons, or by a charge transfer out, an actual physical wire is connected to each separate diode. This provides a huge advantage in improved signal-to-noise ratio. D.L.G.

N74-17415# Monsanto Co., St. Louis, Mo. Electronic Products Div.
THIN FILM OPTICAL WAVEGUIDES IN 3-5 SEMICONDUCTORS Semiannual Technical Report, 31 Dec. 1972 - 1 Jul. 1973
M. George Craford Jul. 1973 84 p refs
(Contract F19628-72-C-0324; ARPA Order 2074)
(AD-769963; AFCRL-TR-73-0533; SATR-2) Avail: NTIS CSCL 20/6

The development of techniques for the growth of large area vapor phase epitaxial GaAs and GaAsP, and liquid phase epitaxial GaAs and GaAlAs, waveguide structures is described. GaAs n/n(+) and GaAs/GaAsP waveguide structures have been grown and evaluated and the results have been compared to calculated attenuation rates. The results demonstrate the advantages of an alloy structure for GaAs waveguides at 10.6 micrometer wavelength. An analysis of waveguides with graded indices of refraction is described. A preliminary demonstration of Bragg's diffraction Electro-optical Modulation in GaAs waveguides has also been obtained. Author (GRA)

N74-17416# Aerospace Corp., El Segundo, Calif. Lab. Operations.
A PHYSICAL MODEL FOR STRONG OPTICAL AMPLITUDE FLUCTUATIONS IN A TURBULENT MEDIUM
Hal T. Yura 15 Oct. 1973 36 p refs
(Contract F04701-73-C-0074)
(AD-770578; TR-0074(4230-30)-2; SAMSO-TR-73-371) Avail: NTIS CSCL 20/6

In the paper a heuristic derivation of the amplitude statistics of a plane wave propagating in a turbulent medium is given. The results are based on a generalization of Tatarskii's geometrical optics model of amplitude fluctuations. For this reason, the results given are to be regarded as an order of magnitude estimate, rather than a rigorous quantitative derivation. The purpose here is to correctly describe the physical optic effects rather than be mathematically rigourous, hence, all multiplicative factors of the order unity are neglected. As is shown, good qualitative agreement with experimental measurements of amplitude statistics is obtained for both variance and covariance measurements. GRA

N74-17417*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
AUTOCORRELATION FUNCTION OF SCATTERED LIGHT FOR A BINARY FLUID NEAR THE CRITICAL MIXING POINT
Cherif Bendjaballah 1973 14 p refs
(Grant NGR-21-002-285; Contract N00014-67-A-0239-0014; Grant NSF GH-33577)
(NASA-CR-136818; AD-769966) Avail: NTIS HC $3.00 CSCL 07D

Using a time to amplitude conversion method, the second order correlation function of the central component in light scattered by a binary fluid was measured very close to the critical point. GRA

N74-17418# Texas Univ., Austin. Electronics Research Center.
MAGNETIC ANOMALY DETECTION UTILIZING COMPONENT DIFFERENCING TECHNIQUES Final Report
Brooks C. Fowler, H. W. Smith, and F. X. Bostick, Jr. 31 Aug. 1973 46 p refs
(Contract N00014-67-A-0126-0011; NR Proj. 371-032)
(AD-770091; TR-154) Avail: NTIS CSCL 17/6

A scheme for the detection of the passage of ships and other permeable objects which uses stationary component magnetometers is described. The system requires as complete a cancellation of the natural geomagnetic micropulsation noise

as is possible in the frequency range from 0.001 to 1 Hz. A simple method for detecting the magnetic anomaly produced by a passing ship is to form the difference between parallel components of the magnetic field variations at each end of a baseline several miles in length. The geomagnetic micropulsation noise tends to cancel, but the target anomaly is more localized and causes each magnetic sensor to operate almost independently for the target detection. However, in many locations the variation in local geology along the baseline introduces a geology filter which must be removed by more elaborate measurement and computation. (Modified author abstract) GRA

N74-17419# Army Electronics Command, Fort Monmouth, N.J.
MAGNETIC ORDERING IN Li(2x)Cr(2x)Ni(2-4x)O2
Arthur Tauber and Ephraim Banks (Polytechnic Inst. of Brooklyn) Nov. 1973 8 p refs
(DA Proj. 1T1-61102-B-11A)
(AD-770362; ECOM-4165) Avail: NTIS CSCL 20/12

Magnetic ordering in the Li(2x)Cr(2x)Ni(2-4x)O2 system has been studied in polycrystalline compositions isotypic with alpha-NaFeO2. The susceptibility measurements obtained between 4.2 and 900K indicated that all compositions investigated ordered antiferromagnetically at low temperatures. (Modified author abstract) GRA

N74-17420# Army Electronics Command, Fort Monmouth, N.J.
LOW TEMPERATURE MAGNETIC PROPERTIES IN BaFe(12-X-Y-Z) Zn(X)Ti(Y)Mn (Z) O19
Joseph P. Mahoney, Arthur Tauber, and Robert O. Savage Nov. 1973 10 p refs
(DA Proj. 1T1-61102-B-11A)
(AD-770361; ECOM-4164) Avail: NTIS CSCL 20/12

The magnetization, anisotropy field and Mossbauer spectra of single-crystal compositions in the system BaFe(12-x-y-z)Zn(x)Ti(y)Mn(z)O19 were investigated between 4.2 and 300K. The magnetization generally decreases both as a function of increasing substituent and temperature. The anisotropy field decreases with increasing substituents but changes little as a function of temperature above 25K for most compositions. The quadrupole splitting at 77K differs little from that found at room temperature while the hyperfine fields have increased considerably. The magnetic moments (H = infinity, T = 0) were computed and together with the Mossbauer data and analytical data a cation distribution was deduced. Author (GRA)

N74-17421# Texas Univ., Austin. Applied Research Labs.
THERMOACOUSTIC ARRAYS Final Report, 1 Jan. - 31 Mar. 1973
Thomas G. Muir 30 Oct. 1973 15 p refs
(Contract N00014-70-A-0166; NR Proj. 261-187)
(AD-770846; ARL-TR-73-55) Avail: NTIS CSCL 17/1

The generation of highly directive sound by thermal expansion of water was researched under the contract and was shown, both theoretically and experimentally, to be possible. This report describes accomplishments to date in the theoretical category, i.e., the formulation of the thermoacoustic array problem in a simple inhomogeneous wave equation and its solutions for several initial conditions. Model tank experiments are described which use a small ruby laser operating in the conventional mode to produce a noise-like pulse absorbed in a copper sulfate solution. Acoustic energy was found to be generated by the thermoacoustic process, over a wide band governed by the frequencies contained in the noise-like laser pulse. (Modified author abstract) GRA

N74-17422# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
ON THE CONSTITUTIVE EQUATIONS OF POLAR ELASTIC DIELECTRICS
H. Demiray and A. C. Eringen Oct. 1973 23 p refs
(Contract N00014-67-A-0151-0004)
(AD-770849; TR-37) Avail: NTIS CSCL 20/3

The balance laws, jump conditions and the nonlinear constitutive equations are formulated for an elastic polar dielectric interacting with a quasi-static electric field, including the quadrupole polarizations. Thermodynamical and other constitutive restrictions are studied. The linearized field equations are employed to solve the problem of a spherical cavity in an infinite solid dielectric subject to a uniformly disturbed surface charge at the surface of the cavity. Author (GRA)

N74-17423# Naval Research Lab., Washington, D.C.
RADIATION EFFECTS IN FIBER OPTIC WAVEGUIDES Interim Report, 1 Mar. - 1 Nov. 1973
G. H. Sigel, Jr. Dec. 1973 41 p
(AD-770850; NRL-MR-2704) Avail: NTIS CSCL 20/6

The effects of gamma ray and pulsed electron irradiation on the optical performance of fiber optic waveguides and glasses potentially relevant to fiber systems have been measured. Permanent and transient absorption, luminescence, scattering and index of refraction measurements are reported. The mechanisms responsible for the optical degradation in commercial and low loss fibers have been investigated. Initial attempts at radiation protection of fiber glasses using cerium doping are discussed. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-17424*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXTENSION OF CASE'S METHOD TO THE TWO-REGION CRITICAL CYLINDER AND ITS APPLICATION AS AN ANALYTIC STANDARD Ph.D. Thesis - Virginia Univ.
Robert Michael Westfall May 1974 130 p refs
(NASA-TM-X-71522) Avail: NTIS HC $9.50 CSCL 20H

The normal mode expansion technique is applied to the transformed monoenergetic integral transport equation to develop a solution for the rotationally invariant and axially infinite, critical, two-region cylinder with a finite outer reflector boundary. Isotropic scattering and identical neutron mean free paths in the core and reflector regions are assumed. The solution in terms of singular integral equations is obtained by applying a completeness theorem found for the singular eigenfunctions. Numerical results for a variety of core and reflector multiplying properties and reflector thickness are presented and compared with the results of other method. An example of this type of application is given in a study of approximations inherent in the neutronic design analysis of a small, fast-neutron-spectrum reactor concept proposed as a space power source. Author

N74-17425*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NONSTATIONARY HOMOGENEOUS NUCLEATION
K. G. Harstad 15 Jan. 1974 35 p refs
(Contract NAS7-100)
(NASA-CR-136830; JPL-TM-33-666) Avail: NTIS HC $4.75 CSCL 20H

The theory of homogeneous condensation is reviewed and equations describing this process are presented. Numerical computer solutions to transient problems in nucleation (relaxation to steady state) are presented and compared to a prior computation. Author

N74-17426# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PERTURBATION THEORIES FOR POLAR FLUIDS
Loup Verlet Nov. 1973 35 p refs
(LPTHE-73/29) Avail: NTIS HC $4.75

The free energy of dense fluids with permanent dipoles is computed through the Monte Carlo method with two types of intermolecular interaction: Stockmayer potential and hard sphere potential with an added dipolar interaction. A comparison is made with the Pade representation. In the case of hard spheres with permanent dipoles, another equally successful perturbation theory, is proposed, which is based on a partial resummation of the mixed perturbation theory first introduced by Lebowitz, Stell,

and Baer. The perturbation theory is then applied to an interaction composed of a spherically symmetric two body potential with permanent dipoles. Author

N74-17427# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
ANALYSIS OF FORM FACTORS OF THE DISINTEGRATIONS: POSITIVE KAON YIELDS PION POSITIVE MUON NEUTRINO AND POSITIVE KAON YIELDS PION POSITRON NEUTRINO Ph.D. Thesis, 7 Jan. 1972 [ANALYSE DES FACTEURS DE FORME DANS LES DESINTEGRATIONS KAON POSITIF PRODUIT PION MUON POSITIF NEUTRINO ET KAON POSITIF PRODUIT PION POSITRON NEUTRINO]
Le Dong Dec. 1971 198 p refs In FRENCH Sponsored by CNRS
(LAL-1255) Avail: NTIS HC $13.00

Semileptonic K-meson disintegration into three bodies was studied with regard to neutral pion-positive muon-neutrino and neutral pion-positron-neutrino modes. The data were taken from the X2 CERN experiment. Out of five million K mesons tracks, 5800 were used to determine the ratio of the form factors for the muon mode and 3230 for the positron mode. A review of the form factor theory is detailed together with parameters of interest and necessary physical quantities to be measured. The general experimental setup and data reduction procedures are presented. Specific topics, such as branching ratio measurements and Dalitz diagram studies, are dealt with in regard to applied corrections, kinematics, acceptance and detection functions, impulse transfer, and residual bias. Results are discussed and compared to various theoretical predictions with regard to SU3 times SU3 algebra. ESRO

N74-17428# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
MEASUREMENT OF DIFFERENTIAL CROSS SECTIONS OF PION AND KAON PRODUCTION ON ALUMINUM AND BERYLLIUM TARGETS AT 24 GeV/c [MESURES DES SECTIONS EFFICACES DIFFERENTIELLES DE PRODUCTION DES MESONS PI ET K SUR CIBLE D'ALUMINIUM ET DE BERYLLIUM A 24 GeV/c]
B. Aubert, L. M. Chounet, and P. Heusse Dec. 1971 19 p refs In FRENCH
(LAL-1259) Avail: NTIS HC $4.00

The differential production cross sections for pions and K-mesons and Al and Be targets at 24 GeV/c are reported. The experiment was made in cooperation with CERN for the production cross section of the nucleus-proton reaction at the same energy and determination of neutrino fluxes. The spectrometer characteristics, Cerenkov counters, and angular acceptance. Various corrections are detailed, in particular, meson disintegration losses, absorption delta ray production Cerenkov counters, and beam contamination by disintegration muons. Absolute errors on cross sections are between 15 to 18% while relative production rate errors lie between 5 to 7%. ESRO

N74-17429# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
LIQUID DEUTERIUM TARGET [CIBLE A DEUTERIUM LIQUIDE]
D. Blum, J. Boucrot, W. McGill, Ngoc H. Nguyen, B. Grossetete, J. P. Henault, R. Motta, M. Roch, and V. Round May 1972 22 p In FRENCH; ENGLISH summary
(LAL-1263) Avail: NTIS HC $4.25

An original liquid deuterium target was built to study the interaction of monochromatic gamma rays of 400 MeV with deuterons. The description and the performances of the target and of the automatic system which provides it with liquid deuterium during several weeks, without any human intervention, are detailed with regard to closed circuit reliquefier, liquid deuterium transfer line, thermal insulation vacuum chamber for the target, liquid deterium target, return gas line, and liquid level regulation. Author (ESRO)

N74-17430# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
PROPERTIES OF NINE MULTIWIRE PROPORTIONAL CHAMBER FOR THE EXPERIMENT GAMMA PLUS D YIELDS NEGATIVE PION PLUS P PLUS P Ph.D. Thesis [PROPRIETES DES NEUF CHAMBRES MULTIFILS PROPORTIONNELLES DE L'EXPERIENCE GAMMA PLUS D PRODUIT PION NEGATIF PLUS P PLUS P]
J. Boucrot Jun. 1973 55 p refs In FRENCH
(LAL-1267) Avail: NTIS HC $5.75

The construction and associated electronics for nine multiwire proportional chambers for nuclear reaction are presented. The interaction and multiplication mechanisms in proportional counters are reviewed. The technical realization of a multiwire proportional chamber is outlined with regard to chamber body, anode wires, soldering, and test techniques. Performance tests are discussed taking into account gas mixture choice, particle detection characteristics, coincidence rate, wire collection factor, efficiency, and influencing parameters such as jitter. Associated electronics, considering spark protection, voltage amplifiers, read out logic, physical location, tests, and threshold stability, are discussed. ESRO

N74-17431# Paris Univ., Orsay (France). Lab. de L'Accelerateur Lineaire.
SOME EXPERIMENTAL EVIDENCE OF VIRTUAL COMPTON SCATTERING OBTAINED AT 990MeV WITH THE ORSAY STORAGE RING
G. Cosme, B. Jean-Marie, S. Jullian, F. Laplanche, G. Parrour, and G. Szklarz Jul. 1973 12 p refs
(LAL-1268) Avail: NTIS HC $4.00

The positron electron yields photon annihilation cross section was measured. A significant fraction of the observed electron photon events does not arise from an experimental conversion of one of the photons of the two-photon channel. Using these events a good experimental configuration of the theoretical expectations was found with regard to the contribution of a quasi-real Compton scattering to the positron electron reaction. ESRO

N74-17432# Paris Univ., Orsay (France).
ON A SIMPLE METHOD FOR MEASURING THE MOMENTS OF NEUTRAL PION MULTIPLICITY DISTRIBUTION
D. Fournier, J. F. Rivaz, and J. J. Geillet Sep. 1973 14 p refs
(LAL-1269) Avail: NTIS HC $4.00

A method for measuring the first binomial moments of the multiplicity distribution of neutral pion produced in high energy interactions is presented. The method is based on the fact that, for a given event, the probability distribution of the distance between the interaction vertex and the nearest photon vertex is determined by the number of neutral pions produced. The parameters of the distribution then measurable are the binomial coefficients. The method does not require unreasonable statistics in large bubble chambers and can be extended to discontinuous detection. The variation of the materialization length of photons with energy is not a crucial problem. Author (ESRO)

N74-17433# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
RADIOACTIVE DECAY OF NEUTRAL OMEGA AND NEUTRAL PHI VECTOR MESONS BY ELECTRON POSITRON ANNIHILATION Ph.D. Thesis [ETUDE DES DESINTEGRATIONS RADIATIVES DES MESONS VECTORIELS OMEGA NEUTRE ET PHI NEUTRE PAR ANNIHILATION ELECTRON POSITRON]
Gerard Cosme Apr. 1972 169 p refs In FRENCH
(LAL-1261) Avail: NTIS HC $11.50

The analysis of neutral anodes at the neutral PHi meson and neutral omega-meson resonances under radioactive decay is presented. The experimental setup is given with regard to ACO storage ring structure and parameters, spark chambers and associated electronics, scintillation counters, and triggering logics. Efficiency is discussed in relation to a Monte Carlo simulation program, and tests of efficiency are presented. The data analysis is reviewed with regard to geometry of events and kinematics, noise, three gamma events, coplanarity, and a special study presented for the energy 495 MeV. Results are discussed in relation to vector meson theories such as the vector dominance model, SU3, and quarks. ESRO

N74-17434# Paris Univ., Orsay (France).
PHOTOPRODUCTION OF NEGATIVE PIONS ON DEUTERON IN THE FIRST RESONANCE REGION Ph.D. Thesis [CONTRIBUTION A L'ETUDE DE LA PHOTOPRODUCTION DU PION NEGATIF SUR LE DEUTERON DANS LA REGION DE LA PREMIERE RESONANCE]
J. Boucrot Jun. 1973 207 p refs In FRENCH
(LAL-1267) Avail: NTIS HC $13.50

The photoproduction of negative pions on deuterons at energies between 290 and 520 MeV positron energy is presented. Theoretical aspects of photoproduction on free neutron and deuteron are reviewed with regard, in the latter case, to the spectator proton approximation and double diffusion or Coulomb interaction processes. The experimental setup is detailed with regard to the special deuterium liquid chamber, the original multiwire proportional chambers, and the on-line data acquisition system. The experimental data analysis is reviewed, detailing the momentum calculation and forward angle proton emission, the proton-negative pion coincidences, noise calculations, and the synchronization events treatment. Verification of the results is performed by considering the neutral pion photoproduction on protons. Results of the experiment are discussed with regard to the spectator proton momentum distribution and differential cross section determination where the various corrections required are considered. Interpretation of the results is proposed by comparison with the Desy results and those of Frascati, excluding the existence of an isotensorial component. ESRO

N74-17435# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
OBSERVATIONS OF SELECTIVE DIFFRACTION IN SODIUM VAPOUR
Yngve Oehman (Stockholm Univ.) and Lennart Lindberg Nov. 1973 10 p refs
(TRITA-EPP-73-18) Avail: NTIS HC $4.00

Observations of diffraction produced by four slabs of heated sodium vapor in argon separated by equally thick slabs of argon without sodium vapor are reported. Well defined first order diffraction images were clearly recorded in the sodium lines. Author (ESRO)

N74-17436# Air Force Weapons Lab., Kirtland AFB, N.Mex.
ELECTRON ENERGY DEPOSITION IN ATMOSPHERIC GASES Technical Report, 15 Aug. 1972 - 31 May 1973
Peter W. Lunn Oct. 1973 143 p refs
(AF Proj. 8809)
(AD-769909; AFWL-TR-73-173) Avail: NTIS CSCL 18/3

To compute state-by-state electron-impact cross sections, energy loss functions, and secondary electron distributions in energy regions where little or no experimental data exist, an electron energy deposition code (HARMONY) was developed that extends the available low-energy (below 1 to 10 keV) state-by-state calculations out to 10 MeV. The resulting energy loss functions agree quite well with the available experimental or theoretical data. The HARMONY code is presented and the energy regions for each of nine atmospheric gases are discussed for which a Born approximation and a modified Born approximation were used. Since the HARMONY code is based on the University of Florida Aeronomy Group's AURORA code, a low-energy code, emphasis is placed on the improvements made for intermediate and high energies, which include a bremsstrahlung loss and relativistic modifications. Author (GRA)

N74-17437# Naval Research Lab., Washington, D.C.
A FORTRAN PROGRAM TO ANALYZE GAMMA-RAY SPECTRA RECORDED WITH Ge (Li) DETECTORS Final Report
R. E. Larson and J. L. Repace Oct. 1973 53 p refs
(AD-769219; NRL-MR-2658; NRL-Computer-Bull-34) Avail: NTIS CSCL 20/8

The set of routines was specifically designed for gamma-ray spectral analysis using a high resolution lithium-drifted germanium detector and a 4096 channel pulse height analyzer, with gainsettings of from .25 to 4 keV per channel. It was written to reproduce the results of manual analysis of spectra. Options provide data acquisition from magnetic tape, paper tape, or data cards. The program determines all statistically significant peaks and computes the energy and area of each peak for up to 512 peaks per spectrum. Author (GRA)

N74-17438# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.
ELECTRON COLLISIONS AND CROSS SECTIONS IN HYDROGEN
Stanford P. Yukon Jan. 1973 154 p refs
(Contract F19628-71-C-0079; AF Proj. 8659)
(AD-763087; AFCRL-TR-73-0192) Avail: NTIS CSCL 07/4

Cross sections for inelastic scattering of electrons on molecular hydrogen are determined using single center wave functions. Transitions among the 9 states X,B,C,E,B',a,b,c,e are calculated for a range of energies using various approximations for the exchange scattering amplitude. For more accurate low energy cross sections Seaton's partial wave analysis for atomic hydrogen is extended here to molecular hydrogen. Author (GRA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-17439 State Univ. of New York, Buffalo.
ANALYTICAL STUDY OF MAGNETICALLY BALANCED CROSS-FLOW ARCS Ph.D. Thesis
Vaman Ramarao Malghan 1973 300 p
Avail: Univ. Microfilms Order No. 73-29114

An analytical study was carried out for the steady-state magnetically balanced cross-flow arc configuration. An iterative procedure was developed to solve the governing magnetohydrodynamic equations. The effects of induced fields are included in the analysis. Upon specification of two independent variables, arc current and mainstream velocity, along with other required implicit inputs (the phenomenological relations for arc drag coefficient and Nusselt number), the analysis determines both the flow and temperature fields and the shape of the arc boundary; a priori assumptions of these quantities are not required. The analysis predicts two types of flow fields. Depending upon the operating conditions, the mainstream flow will pass through the arc or a dividing streamline will be formed (inside of which double vortex flow occurs). The effect of the induced field is to shift the streamlines toward the arc boundary; its influence on isotherm distributions is of second order. Dissert. Abstr.

N74-17440 State Univ. of New York, Buffalo.
DYNAMIC TEMPERATURE MEASUREMENTS IN AN ac CASCADE ARC PLASMA Ph.D. Thesis
Marlin R. Gillette 1973 186 p
Avail: Univ. Microfilms Order No. 73-29093

The objective of the experiments performed was to measure the radial distribution of temperature, as a function of time of an atmospheric argon arc-plasma in a wall stabilized ac arc tunnel. The emphasis of the measurements was upon the determination of this profile at and near the current zero crossing. A wall stabilized ac-arc tunnel apparatus was designed and fabricated. Temperatures were determined through measurement of the absolute continuum radiation spectra power emitted in a small wave-length interval in the visible portion of the argon spectrum. The experimental apparatus included the ancillary synchronization electronics necessary for synchronization of the relative time position of a high speed rotating mirror with respect to the arc exciting source function. The high speed rotating mirror time resolved the time varying arc radiation by sweeping an image of the arc cross-section across the entrance slit of the optical detection system. Dissert. Abstr.

N74-17441 California Inst. of Tech., Pasadena.
AN INVESTIGATION OF COLLISIONLESS PLASMA BEAM INTERACTION WITH A NONHOMOGENEOUS MAGNETIC FIELD Ph.D. Thesis
Peter Hoong-Yee Lee 1973 162 p
Avail: Univ. Microfilms Order No. 73-31049

The interaction between a rarefied flowing plasma and an externally imposed nonhomogeneous magnetic field is studied experimentally in a collisionless plasma wind tunnel, where a

collisionless plasma beam is directed through a current loop. The collisionless plasma is generated by an electron bombardment engine. Radial density profiles in the wake of the current loop mapped by the two-probe method indicate annular density peaks at certain radial positions. In order to understand this nonuniform pinching process, a theoretical analysis is attempted. It is found that the experimentally observed phenomenon can be qualitatively described by the collisionless two-fluid equations, but turbulent friction is required to improve the two-fluid model. A heuristic turbulent model is used, and evidence of turbulence in the flow field is also obtained through measurements of the fluctuating probe currents. Dissert. Abstr.

N74-17442*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ITERATIVE METHODS FOR PLASMA SHEATH CALCULATIONS: APPLICATION TO SPHERICAL PROBE

L. W. Parker and E. C. Sullivan Washington Mar. 1973 20 p refs

(NASA-TN-D-7409; G-7337) Avail: NTIS HC $3.00 CSCL 20I

The computer cost of a Poisson-Vlasov iteration procedure for the numerical solution of a steady-state collisionless plasma-sheath problem depends on: (1) the nature of the chosen iterative algorithm, (2) the position of the outer boundary of the grid, and (3) the nature of the boundary condition applied to simulate a condition at infinity (as in three-dimensional probe or satellite-wake problems). Two iterative algorithms, in conjunction with three types of boundary conditions, are analyzed theoretically and applied to the computation of current-voltage characteristics of a spherical electrostatic probe. The first algorithm was commonly used by physicists, and its computer costs depend primarily on the boundary conditions and are only slightly affected by the mesh interval. The second algorithm is not commonly used, and its costs depend primarily on the mesh interval and slightly on the boundary conditions. Author

N74-17443# Institute of Plasma Physics, Prague (Czechoslovakia).

ABSORPTION OF THE MICROWAVE ENERGY IN A MAGNETOACTIVE PLASMA

J. Musil and F. Zacek May 1972 16 p refs

(IPPCZ-164) Avail: NTIS HC $4.00

An experimental study was made of the possibility of microwave energy absorption in a magnetoactive plasma at arbitrary values of the magnetic field. Data cover values of B < B, B is approximately equal B sub ce, and B > B, B sub ce is the magnetic field corresponding to the electron cyclotron resonance. Author

N74-17444# Institute of Plasma Physics, Prague (Czechoslovakia).

THE ROLE OF LINEAR DAMPING FOR EXPLOSIVE INSTABILITIES

K. Jungwirth Feb. 1972 14 p refs

(IPPCZ-166) Avail: NTIS HC $4.00

One type of interaction of the conservation laws of energy and momentum is discussed. The role of linear damping of the interacting waves, assuming that conditions for the excitation of an explosive instability of marginally stable waves were satisfied, is discussed. The phases of the waves are excluded. General information without knowledge of the concrete properties of the medium and of the waves can be derived. Author

N74-17445# Institute of Plasma Physics, Prague (Czechoslovakia).

PENETRATION OF HIGH-FREQUENCY WAVES INTO A WEAKLY INHOMOGENEOUS MAGNETIZED PLASMA AT OBLIQUE INCIDENCE AND THEIR TRANSFORMATION TO BERNSTEIN MODES

J. Preinhaelter and V. Kopecky Sep. 1972 29 p refs

(IPPCZ-168) Avail: NTIS HC $4.50

A propagation of high frequency electromagnetic waves in a weakly inhomogeneous magnetized plasma is investigated. The density gradient was supported to be perpendicular to an external magnetic field and the waves to be incident obliquely upon the plasma from vacuum. It was found that the transmission coefficient of the ordinary wave through the plasma resonance is approximately equal to one in a fairly wide range of angles of incidence. The transmitted ordinary wave is, at great densities, completely transformed into an extraordinary wave. Then it propagates back to the region of smaller density and is completely transformed into the Bernstein modes in the place of the hybrid resonance. Complications connected with the evanescent layer which arise when the high frequency energy is transmitted into the plasma in the form of the extraordinary wave can thus be removed by using the ordinary wave with the angle of incidence chosen appropriately. Author

N74-17446# Institute of Plasma Physics, Prague (Czechoslovakia).

MICROWAVE HEATING OF ELECTRONS OF A DENSE PLASMA COLUMN AT FREQUENCIES HIGHER THAN ELECTRON CYCLOTRON FREQUENCY, PART 1

J. Datlov, L. Kryska, and V. N. Budnikov Sep. 1972 21 p refs

(IPPCZ-169-Pt-1) Avail: NTIS HC $4.25

The absorption of plasma waves, excited in a dense plasma column was investigated and the localization of the regions of efficient heating of electrons were determined in a broad range of plasma parameters. The heating of electrons near the second electron cyclotron harmonic was investigated in more detail. Author

N74-17447# Institute of Plasma Physics, Prague (Czechoslovakia).

EFFECT OF TRAPPED BEAM ELECTRONS ON NONLINEAR BEAM-PLASMA INTERACTION

K. Jungwirth, V. Piffl, and J. Ullschmied Jun. 1972 53 p refs

(IPPCZ-165) Avail: NTIS HC $5.75

The experimental and theoretical results of a study of the Cherenkov type of nonlinear interaction of a cold electron beam with a magnetized plasma are discussed. In the initial stage, a single quasimonochromatic wave determining the dynamics of the nonlinear interaction is excited in the system. Then the energy released by the retardation of the beam as a whole is transferred mainly to the excited wave and the problem may be solved numerically and simultaneously for any combination. Experimentally, the averaged beam distribution function in various stages of the interaction, the phase velocity of the excited wave and the spatial dependence of its amplitude have been measured. Satellites of the basic wave have been observed and their frequencies determined. In the regimes in which a single strong wave is excited, an agreement between the calculated and measured values has been found. Author

N74-17448# Institute of Plasma Physics, Prague (Czechoslovakia).

THE BEHAVIOUR OF A WEAKLY IONIZED GAS IN CROSSED ELECTRIC AND MAGNETIC FIELDS. PART 1: DESCRIPTION OF WEAKLY IONIZED GAS FROM MACROSCOPIC VIEWPOINT (CONTINUUM THEORY)

Pavel Vrba Nov. 1972 140 p refs

(IPPCZ-174-Pt-1) Avail: NTIS HC $10.00

The continuum theory and plasma properties are described, along with basic macroscopic equations. The behavior of a weakly ionized gas is analyzed, confined by cylindrical electrodes and dielectric fronts. Spatial dependence of quantities describing a stationary plasma is determined. The magnitude of the electrode boundary layer is also estimated. J.A.M.

N74-17449# Institute of Plasma Physics, Prague (Czechoslovakia).

THE BEHAVIOUR OF A WEAKLY IONIZED GAS IN CROSSED ELECTRIC AND MAGNETIC FIELDS, PART 2

Pavel Vrba Nov. 1972 70 p

(IPPCZ-175-Pt-2) Avail: NTIS HC $6.50

The evolution of molecular system were studied. The main concern is devoted, not only to the state of the system at a given time point, but also to the way this state is achieved. Weekly ionized gas based on the solution of Boltzmann's equations is described. The determined distribution functions characterize the behavior of molecular species in space and time. Maxwell-Boltzmann's equations are solved by the Chapman-Enskog's

approximate method. The first and the second approximation of the distribution function was derived. Author

N74-17450# Institut Atomnoi Energii, Moscow (USSR).
CONDITIONS FOR OBTAINING A POSITIVE ENERGY BALANCE FOR A BETA EQUALS 1 PLASMA IN A TRAP WITH MAGNETIC MIRRORS
A. V. Bortnikov and N. N. Brevnov 1972 10 p refs In RUSSIAN
(IAE-2184) Avail: AEC Depository Libraries HC $3.00

The plasma may be obtained by rapid heating of a given amount of material with laser or electron beams. Author (NSA)

N74-17451# United Kingdom Atomic Energy Authority, Culham (England).
THERMODYNAMIC STABILITY OF COLLISIONLESS PLASMAS
E. Minardi May 1973 7 p refs Presented at Innsbruck Conf., 1-7 Apr. 1973
(CLM-R-124) Avail: AEC Depository Libraries HC $3.00; HMSO 50 p; PHI $2.15

The stability of Vlasov's equilibria can be described by a theory with a thermodynamic structure. This is achieved starting from a plasma model in which a given collective equilibrium, described by a time independent solution of the Vlasov equation, is superimposed on a homogeneous plasma background. By means of this procedure the entropy of a collisionless equilibrium and the other thermodynamic potentials can be calculated. An equilibrium is declared unstable if neighboring equilibria can be reached, with a given thermodynamic process, such that the entropy increases while the system remains isolated. In all cases where an analytical computation is possible the thermodynamic criteria are shown to contain the instability criteria of the dynamics while, for inhomogeneous situations, new instability conditions are obtained. A sufficient criterion for instability with respect to dissipative processes, derived with the above thermodynamic method, was recently verified by computer calculations both in the cases of an electrostatic or a gravitational strongly inhomogeneous Vlasov's equilibrium. Author (NSA)

N74-17452# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
CONTINUOUS DROPLET SOURCE FOR PLASMA PRODUCTION WITH PULSE LASERS
U. Schwenn and R. Sigel May 1973 23 p refs In GERMAN; ENGLISH summary
(IPP-4-47) Avail: AEC Depository Libraries HC $3.25

The principle of a continuous droplet source for plasma production with a repetitively pulsed laser is described. A prototype was successfully operated with water. Author (NSA)

N74-17453# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
STOCHASTIC HEATING OF PLASMA ELECTRONS USING MICROWAVE
S. Puri Jun. 1973 30 p refs
(IPP-4-57) Avail: AEC Depository Libraries HC $3.50

A mirror-contained hydrogen plasma of approximately 1 liter volume, 1 x 10 to the 11th power/cu cm density, and 1 keV temperature is produced using 100-watt broadband microwave noise at the electron cyclotron resonance. In contrast to the single-frequency heating, noise heating is stable, repeatable, and more efficient. The use of Ioffe bars is found to be indispensable in suppressing the low-frequency instabilities and the attendant plasma loss, as well as for assuring reproducibility. Detailed density, diamagnetic, and energy-analyzer measurements are presented for several values of power input, noise bandwidth and gas pressure. Independent measurements of density and diamagnetic signal decay in the afterglow plasma are also given. Author (NSA)

N74-17454# Paris Univ., Orsay (France). Lab. of Plasma Physics.
DESCRIPTION OF THE ENERGY SOURCE PROJECT DELIVERING 1 MEGAJOULE IN 1 MICROSECOND [DESCRIPTION DU PROJET D'UNE SOURCE D'ENERGIE DELIVRANT 1 MEGAJOULE EN 1 MICROSECONDE]
F. Damidau and C. Rioux Apr. 1972 17 p refs In FRENCH
(LF-3) Avail: NTIS HC $4.00

The project for a high energy source delivering one MJ in one microsecond using a unipolar autoexcited ironless rotating generator is presented. Three subsystems are detailed: (1) the primary source mentioned above, delivering one MJ in 0.1 second with one MA current coupled to a magnetic storage coil, (2) a primary transfer coil with high efficiency (transfer time 100 microsecond and associated switching gear; and (3) a secondary transfer coil to reach one microsecond. Circuit breakers required for the various connections are detailed with regard to mechanical devices and exploding wire techniques. Mutually coupled inductances used for high efficiency transfer are described and the sequence of switch operations detailed. ESRO

N74-17455# Paris Univ., Orsay (France). Lab. of Plasma Physics.
TELECOMMAND SUBSYSTEM FOR THE 100 G GENERATOR [PRESENTATION DE L'ENSEMBLE DE TELECOMMANDE DE LA GENERATRICE 100 G]
R. Brimaud Jan. 1973 31 p In FRENCH
(LF-8) Avail: NTIS HC $4.75

The command and control subsystem for the 100 G impulse generator is presented and the location and function of various panels are described. The principles of the automated sequencing required with regard to the phase diagram are detailed. Application of the principles to the 100 G generator is discussed with regard to safety devices and circuit protection. ESRO

N74-17456# Paris Univ., Orsay (France). Lab. of Plasma Physics.
THEORETICAL AND EXPERIMENTAL STUDY OF THE CURRENT DISTRIBUTION IN COILS COUPLED TO IMPULSE DYNAMOS [ETUDE THEORIQUE ET EXPERIMENTALE DES DISTRIBUTIONS DE COURANT DANS LES BOBINES ACCOUPLEES AUX DYNAMOS IMPULSIONNELLES]
B. Geoffrion and M. Legentil Mar. 1973 29 p refs In FRENCH; ENGLISH summary
(LF-10) Avail: NTIS HC $4.50

The features of coils to be coupled to homopolar impulse generators were determined in order to maximize transfer efficiency from kinetic to magnetic energy. The current distribution inside the coils was computed, together with the resulting magnetic induction, and a comparison was made with experimental results obtained using a 5 MJ generator. Author (ESRO)

N74-17457# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
POLARIZATION MEASUREMENT ON SPECTRAL LINES OF LOW INTENSITY AND SHORT DURATION
L. Danielsson and L. Lindberg Oct. 1973 22 p refs
(TRITA-EPP-73-17) Avail: NTIS HC $4.25

Measurement of the polarization of spectral lines emitted from a plasma in a magnetic field can give valuable information about anisotropy of the electron velocity distribution. Technically this means measurement of the polarization of a weak, moving, three-dimensional light source of short duration. Careful design and adjustment of the optical and photoelectric equipment is necessary to avoid systematic error sources. The design and optimization of the equipment is discussed in detail. Measurements were made of helium lines at a helium density of about 10 to the 20th power/cu m (5 mTorr). Author (ESRO)

N74-17458# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
MICROWAVE INTERFEROMETER WITH DIGITAL READOUT FOR LARGE NUMBERS OF FRINGES
C. A. J. Hugenholtz and A. J. Putter Sep. 1973 9 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-73-81) Avail: NTIS HC $4.00

The large number of fringes from a microwave interferometer, if applied to large dimension, high density plasmas such as in modern Tokamak experiments, makes readout increasingly difficult. For this reason fringe counters are designed with which the number of fringes (or half fringes) can be recorded as a function of time. Author (ESRO)

N74-17459# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
IDEAL MHD-EQUILIBRIUM OF A TOROIDAL FORCE-FREE PLASMA IN A TRKAL FIELD UP TO THIRD ORDER IN THE INVERSE ASPECT RATIO
W. Schuurman Jul. 1973 12 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO), and EURATOM
(Rept-73-79) Avail: NTIS HC $4.00

The ideal MHD equilibrium configuration of a plasma ring (large radius R, small radius b) embedded in a Trkal magnetic field (j=alpha b) is considered. The convergence of a series expansion of the magnetic flux in the inverse aspect ratio up to third order is investigated. For small alpha, the first order correction is o(alpha squared, b to the 3rd power/r), all other orders being b/R times the next lower one. As expected, the second order effect on the toroidal shift of the magnetic axis vanishes. Author (ESRO)

N74-17460# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
MHD-EQUILIBRIUM OF A BELT-SHAPED PLASMA IN A TRKAL FIELD
J. A. Hoekzema and W. Schuurman Jul. 1973 19 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO), and EURATOM
(Rept-73-78) Avail: NTIS HC $4.00

The MHD equilibrium of a cylindrical plasma sheet of finite thickness surrounded by a Trkal magnetic field and in between two coaxial metallic walls is investigated. The plasma has a sharp boundary and carries a surface current only. Inside the plasma there is a trapped toroidal magnetic field. By applying a one-dimensional model the effects of top and bottom ends of a finite structure are neglected. However, the correspondence between magnetic surfaces on both sides of the plasma sheet is retained. A number of numerical examples show how the displacement of the central plasma column depends on various parameters. The equilibrium characteristics are improved by currents in the region outside the main plasma sheet. If the ratio between the height and the average major radius of the device is somewhat larger than the safety factor q, the equilibrium displacement is tolerable even for high values of beta.
Author (ESRO)

N74-17461# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
EXPERIMENTAL STUDY OF ION HEATING BY WAVE MIXING IN AN ELECTRON-CYCLOTRON-RESONANCE PLASMA Ph.D. Thesis - Utrecht Univ.
L. C. J. M. DeKock Sep. 1973 93 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO), and EURATOM
(Rept-73-80) Avail: NTIS HC $7.75

An ion heating experiment is described in which the exciting field is produced by the nonlinear interaction of two electromagnetic waves in a region close to electron cyclotron resonance. The plasma is sustained by these waves in a simple magnetic bottle. A high neutral density Torr in He gas is required to maintain the discharge at a typical incident power. Low temperatures for the ions and electrons are the results. The confinement is dominated by the ambipolar loss of the ions from the bottle. The main loss of energy is by electrons that gain energy in the resonance regions and further scatter on the high concentration of neutrals. The usual hot electron component has a low density and a low temperature. Enhancement of ion heating is demonstrated when the heat frequency of the electromagnetic waves is approximately equal to the ion cyclotron frequency. Maximum overall efficiencies of 1% have been obtained. Author (ESRO)

N74-17462# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTICAL BREAKDOWN OF COMPRESSED GASES BY CO2 LASER EMISSION
H. G. Basov, E. M. Belenov, V. A. Danilychev, O. M. Kerimov, and I. B. Kovsh 9 Nov. 1973 14 p refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 63, no. 6, 1972 p 2010-2014
(AD-770440; FTD-HT-23-476-74) Avail: NTIS CSCL 20/9

The phenomenon of compressed gas breakdown by CO2 laser emission is examined both theoretically and experimentally. It was disclosed that gas breakdown at high pressures (p > or = 30 atm) differs considerably from that at low pressures: the threshold density of the emission flux and energy appear in the low pressure region as diminishing functions of p and in the high pressure region, conversely, they increase. The dependences of emission threshold density and energy in pressure are different for molecular and atomic gases. GRA

N74-17463# California Univ., Los Angeles. School of Engineering and Applied Science.
WAVE-ENERGY TRANSFER IN TIME-DEPENDENT NONLINEAR WAVE-WAVE INTERACTIONS
P. K. C. Wang Aug. 1973 25 p refs
(Grant AF-AFOSR-2303-72; AF Proj. 9752)
(AD-769978; UCLA-ENG-7363; AFOSR-73-2028TR) Avail: NTIS CSCL 20/9

The wave-energy transfer in a system of three nonlinearly interacting waves with well-defined phases and time-dependent complex wave-frequencies and coupling coefficients is studied. Necessary and sufficient conditions for the unidirectional transfer of wave-energy and their relation to instability are established. Also, sufficient conditions for the nonexistence of explosive instabilities are derived. Finally, results are obtained for the special case where one of the waves is intense and the wave frequencies and coupling coefficients fluctuate with time about their mean-values. Author (GRA)

N74-17464# Naval Research Lab., Washington, D.C.
ANOMALOUS RESISTIVITY IN THE AURORAL PLASMA Interim Report
Konstatinos Papadopoulos and Timothy P. Coffey Oct. 1973 18 p refs
(NRL Proj. 77A03-16; RR0330242)
(AD-770119; NRL-MR-2661) Avail: NTIS CSCL 20/9

The stabilization of fast precipitating electron bursts in the auroral plasma by parametric spectral transfer of waves out of their region of generation, results in a non-linear equilibrium, composed of an enhanced wave spectrum of high frequency oscillations and very low frequency ion density fluctuations. It is shown that the wave particle scattering due to the enhanced spectrum of the low phase velocity ion fluctuations can increase the d.c. resistivity of the auroral plasma by several orders of magnitude. Author (GRA)

N74-17465# Naval Research Lab., Washington, D.C.
BOUND-BOUND RADIATION/COLLISONAL RADIATIVE RECOMBINATION IN OXYGEN AND NITROGEN PLASMA Topical Report, 1 Jan. - 30 Jun. 1973
Larry A. Jones, Hans R. Griem, and Edgar A. McLean 24 Sep. 1973 21 p
(ARPA Order 1433)
(AD-770195; DNA-3163T) Avail: NTIS CSCL 20/9

An existing theta-pinch device has been modified to produce a low density, slowly decaying, nonthermal plasma. Using this plasma as a light source, the absolute intensity of visible line radiation originating, via dipole transitions, from the upper levels of interest can be measured. These measurements in conjunction with known atomic transition probabilities directly yield the population number densities of these upper levels. Laser scattering has been used as a diagnostic tool. GRA

N74-17466# Illinois Univ., Urbana. Particle Research Lab.
INJECTION OF SMALL MACROSCOPIC PARTICLES IN PLASMA AS A DIAGNOSTIC TECHNIQUE
Themistocles C. Anestos and Charles D. Hendricks Aug. 1973 89 p refs
(Grants AF-AFOSR-1508-68; AF-AFOSR-2481-73; AF Proj. 9752)
(AD-770696; CPRL-3-73; UILU-ENG-73-2556; AFOSR-73-2069TR) Avail: NTIS CSCL 20/9

A method for the determination of the electron temperature of a plasma by measuring the charge acquired by a small spherical macroscopic particle of the order of 25 micron diameter as it travels through the plasma is investigated. The particles are generated by the electromechanical breakup of a liquid jet. The plasma is created inside a cylindrical magnetron, which uses

crossed electric and magnetic fields. (Modified author abstract) GRA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-17467 Post Office Research Dept., London (England).
ION IMPLANTATION IN GALLIUM ARSENIDE: ELECTRICAL CHARACTERIZATION OF A GALLIUM ARSENIDE LAYER FOLLOWING IMPLANTATION WITH CADMIUM
T. Ambridge and R. Heckingbottom 3 Jul. 1972 17 p refs
(Rept-298) Copyright. Avail: Issuing Activity

The advantages of ion implantation as a controlled means of introducing a dopant into a semiconductor during device fabrication are being demonstrated on a wide front. These advantages include higher operating speeds, greater packing densities, higher-value resistors, and lower operating voltages. Most of this greater technical capability was achieved only in silicon technology. This is a preliminary attempt to apply ion implantation to gallium arsenide (a material which has advantages over silicon for use in microwave solid state sources in a frequency band which may well extend to millimetric waves). Sheet carrier concentration and effective mobility were determined as a function of annealing temperature, following implantation of cadmium. Conversion of n-type gallium arsenide to p-type is achieved for an annealing temperature of about 600 C, but the doping efficiency is poor. The latter improves, and the mobility approaches the theoretical value by 700 C, but above this temperature the results are dominated by a thermal n- to p-type conversion. The results are discussed in terms of established solid-state theory. Author

N74-17468*# Brown Univ., Providence, R.I.
EFFECTS OF SIZE, SHAPE, AND FREQUENCY ON THE ANTIFERROMAGNETIC RESONANCE LINEWIDTH OF MnF Final Technical Report, Nov. 1966 - Jun. 1973
Kevin C. OBrien Sep. 1973 22 p refs
(Grant NGL-40-002-042)
(NASA-CR-132900) Avail: NTIS HC $3.25 CSCL 20L

The research concerning the properties and application of solid state materials at submillimeter frequencies is summarized. Work reported includes: far infrared Fourier spectroscopy; studies of the antiferromagnetic resonance line in MnF2 at millimeter wavelengths; numerical solution of the equations of motion of a general two-sublattice antiferromagnet; study of antiferromagnetic resonance line in NiO powder; and resonance investigations of several indium thisospinels at millimeter wavelengths. Author

N74-17469*# Scientific Translation Service, Santa Barbara, Calif.
THE ROLE OF SURFACE STATES IN THE FORMATION OF A SCHOTTKY BARRIER AT A METAL/GALLIUM ARSENIDE CONTACT
G. B. Seyranyan and Yu. A. Tkhorik Wasington NASA Jan. 1974 11 p refs Transl. into ENGLISH from Popuprovodnikovaya Tekhnika i Mikroelektronika, no. 11, 1973 p 34-40 Presented at the 4th All-Union Conf. on Electron. Phenomena on Semiconductor surfaces, Kiev, 1971
(Contract NASw-2483)
(NASA-TT-F-15241) Avail: NTIS HC $4.00 CSCL 20L

Study of the Schottky barrier at the contact between an etched n-GaAs surface and various metals (Ca, Mg, Sn, Ni, Ag and Au). The obtained dependence of the barrier height on the contact potential difference (CPD) indicates that a significant role is played by the CPD and the surface electron state charge in the formation of the barrier. Partial screening of the CPD was observed in a wide forbidden band energy range (the Fermi level at the boundary was displaced approximately 0.4 eV). A relatively weak dependence of the barrier height on the crystallographic orientation of GaAs was observed for most of the investigated metals, while a significant orientation dependence was observed for an Ni-GaAs contact. Author

N74-17470# Hahn-Meitner-Institut fuer Kernforschung, Berlin (West Germany).
STRUCTURAL RESEARCH AND IRRADIATION TESTS IN THE HAHN-MEITNER-INSTITUT, BERLIN
D. Braeunig, U. Kaempf, A. Spencker, and H. G. Wagemann Apr. 1973 68 p refs In GERMAN
(HMI-B-126) Avail: NTIS

Irradiation tests of semiconductor components of the communication satellite Symphonie show an anomalously strong susceptibility to ionizing radiations, which could be a hazard to the satellite mission. This defect is due to instabilities of the semiconductor surfaces, and is hardly recognizable on the non-irradiated component. As these changes can be reversibly recovered by irradiation with Co-60 gamma radiation within the operational temperatures of the component, a radiation preselection of those components which are not suitable for the mission is possible. This is demonstrated for a high voltage diode. NSA

N74-17471# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
FLUX LINES IN TYPE 2 SUPERCONDUCTORS
H. Ullmaier Jun. 1973 188 p refs In GERMAN
(JUL-958-FF) Avail: AEC Depository Libraries HC $11.50

The state-of-the-art of flux lines in type-2 superconductors is presented. NSA

N74-17472# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
GENERAL STUDY OF LIQUID PHASE EPITAXY OF GROUP III-V AND IV-VI BINARY AND TERNARY COMPOUNDS Final Report [ETUDE GENERALE DEL'EPITAXIE EN PHASE LIQUIDE DE COMPOSES BINAIRES ET TERNAIRES GROUPES III-V ET IV-VI RAPPORT FINAL]
Nicole Sol, M. Faure, and M. Moulin [1972] 61 p In FRENCH
(Contract DGRST-70-7-2416)
Avail: NTIS HC $6.25

Three methods for liquid epitaxy for selected binary and ternary systems are presented. A dipping method with low interface gradient and low thermal velocity is described. The instrumentation is vertical with isothermal bath. The method allowed determination of the Ga-As phase diagram and consequent control of saturation and deposit geometry. A vertical drawer instrument was built in a second step yielding a strong temperature gradient above the bath. A high level of purity was obtained by this method. A so-called rotating device was also tested as immersion or extraction of the substrate is performed by rotation. The deposit geometry is not sharp and the experimental conditions appear critical. Saturation controlling systems are also studied. These various methods were applied to ternary systems epitaxy, and the results are discussed. ESRO

N74-17473# Stanford Univ., Calif. Center for Materials Research.
SYNTHESIS OF COMPOUND SEMICONDUCTING MATERIALS AND DEVICE APPLICATIONS Final Report, 1 Jul. 1972 - 30 Jun. 1973
D. A. Stevenson, R. H. Bube, R. S. Feigelson, G. S. Kino, and B. L. Mattes 30 Jun. 1973 123 p refs
(Contract DAHC15-71-G-0006; ARPA Order 1644)
(AD-769764; CMR-73-9) Avail: NTIS CSCL 20/12

Contents: Epitaxial crystal growth; Device applications of GaAs; Relations between dislocations and mechanical properties and the production and characterization of defect structures in compound semiconductors; Scientific aspects of gallium arsenide crystal preparation; The synthesis, characterization and device application of gallium nitride: preparation of GaN light-emitting diodes. GRA

N74-17474# Westinghouse Research Labs., Pittsburgh, Pa.
SUPERCONDUCTING WINDINGS Semiannual Report, 1 May - 31 Oct. 1973
Michael S. Walker and John H. Murphy 29 Nov. 1973 55 p refs
(Contract N00014-73-C-0461; NR Proj. 319-068)
(AD-770602; Rept-73-9J2-CRYEL-R1) Avail: NTIS CSCL 20/3

The objectives of the first year program are (1) to measure

losses in practical superconductors, (2) to measure stability of superconductors in simulated field winding environments, and (3) to analyze the data obtained and make suggestions for improved superconductors. The loss behavior of superconductors was examined for alternating fields superimposed upon fixed bias fields simulating the field conditions that might be observed in a machine. An extensive set of measurements on one practical superconductor has been completed, and measurements on several other conductors have been initiated. A parallel effort has been sustained to extend the theory of losses under these field conditions. (Modified author abstract) GRA

N74-17475# Princeton Univ., N.J. Solid State and Materials Lab.
CHARGE TRAPPING EFFECTS IN THIN FILMS OF Al2O3 AND SiO2
Eliyahou Harari Aug. 1973 261 p refs
(Contract N00014-67-C-0151-0034)
(AD-770079; PSSL-121173) Avail: NTIS CSCL 20/12

Electron and hole traps in MIS devices with pyrohydrolytic Al2O3 gate insulator have been investigated, using the MIS device as an integral detector of the charge stored in the oxide. The same detection technique has been used to investigate ionizing radiation-induced charge trapping effects in thin films of SiO2 incorporated into MIS capacitor structures. (Modified author abstract) GRA

N74-17476# Texas Instruments, Inc., Dallas.
REACTIVE PLASMA DEPOSITION OF GALLIUM NITRIDE EPITAXIAL LAYERS Final Report, 1 Oct. 1972 - 30 Jun. 1973
Klaus C. Wiemer Oct. 1973 49 p refs
(Contract N00014-73-C-0054; NR Proj. 243-008)
(AD-769884; TI-03-73-81) Avail: NTIS CSCL 20/12

The report describes a fundamental research effort to deposit epitaxial layers of gallium nitride (GaN) on suitable substrates using a reactive plasma deposition (RPD) technique and to characterize these layers crystallographically and electrically. RPD, as used here, is a method by which compounds are formed through synthesis of suitable source materials in a low-pressure high-frequency electrical discharge. GaN was synthesized by plasma reaction of trimethyl gallium and ammonia on single-crystal (0001) zinc oxide and 1,-1,0,2) sapphire as well as (111) and (100) silicon substrates at temperatures in the range of 20 to 600C. (Modified author abstract) GRA

N74-17477# California Univ., Riverside. Dept. of Physics.
COMMENTS ON DC CONDUCTIVITY IN AMORPHOUS SEMICONDUCTORS
M. Pollak and B. I. Halperin (Bell Labs., Murray Hill, N. J.) 1973 12 p refs
(Contract N00014-69-A-0200-5005)
(AD-770054) Avail: NTIS CSCL 20/12

A recent paper argued that the electrical conductivity arising from thermal hopping between localized states obeys the law ln sigma is proportional to minus ((T sub zero)/T) to the 1/3 power, at low temperatures. That result is found to be based on several unjustified assumptions, however, and the correct temperature dependence is ln sigma is proportional to minus ((T sub zero)/T) to the 1/4 power, as originally proposed by Mott.
Author (GRA)

N74-17478# Maryland Univ., College Park. Center for Theoretical Physics.
STATISTICAL MECHANICS OF ONE-DIMENSIONAL GINZBURG-LANDAU FIELDS. 2: A TEST OF THE SCREENING APPROXIMATION (N TO THE MINUS ONE POWER EXPANSION)
Richard A. Ferrell and Douglas J. Scalapino (Calif. Univ., Santa Barbara) Sep. 1973 80 p refs Sponsored in part by NSF
(Contract N00014-67-A-0239-0019)
(AD-769854; TR-74-026) Avail: NTIS CSCL 20/12

The report concerns the classical statistical mechanics of an n-dimensional order parameter which exists in one spatial dimension. This many-body (field) problem was reduced to a quantum mechanical one-body problem which was solved numerically. It, therefore, provides a convenient testing ground for studying the convergence as well as understanding the nature of approximations used for higher spatial dimensions. It is shown how the results for finite n converge toward the n = infinity answer. In addition, the authors investigated the (1/n) expansion by computing the first and second order corrections to the n = infinity result. GRA

N74-17479# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
JOINT SERVICES ELECTRONICS PROGRAM Semiannual Progress Report, 1 Jan. - 30 Jun. 1973
Oct. 1973 76 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0005)
(AD-770143; SAPR-86) Avail: NTIS CSCL 20/12

Contents: Very low frequency wave propagation; Electron and solid state physics; Control theory and applications: (Systems analysis and control, control and optimization); Electronic circuits and instrumentation; Electromagnetic phenomean: (Antennas, coupled antennas and arrays, antennas and waves in dielectric, conducting, and plasma media). GRA

N74-17480# California Univ., Berkeley. Dept. of Physics.
CONVERSION GAIN IN A JOSEPHSON EFFECT MIXER
Y. Taur, J. H. Claassen, and P. L. Richards Oct. 1973 16 p refs
(Contract N00014-69-A-0200-1056)
(AD-769890) Avail: NTIS CSCL 09/5

The measured performance of Nb-Nb point contact Josephson-junctions used as 36 GHz microwave mixers is in good agreement with the predictions of the resistively shunted junction model. Conversion efficiencies greater than one are attained, with mixer noise temperatures comparable with the best competing devices. Author (GRA)

N74-17481# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTEGRATED OPTICAL CIRCUITS Semiannual Technical Summary Report, 1 Jan. - 31 Jul. 1973
Ivars Melngailis, David L. Spears, Gregory E. Stillman, and Charles M. Wolfe 31 Jul. 1973 19 p refs
(Contract F19628-73-C-0002; ARPA Order 2074)
(AD-769858; ESD-TR-73-251) Avail: NTIS CSCL 09/1

A program was initiated to develop materials and device technology in the two compound semiconductor systems In(x)Ga(1-x)As-GaAs and Hg(x)Cd(1-x)Te-CdTe which will form a base for Integrated Optical Circuits applications in the short wavelength (0.9 to 1.1 micrometers) infrared and the long wavelength (10.6 micrometers) regions, respectively. In the In(x)Ga(1-x)As-GaAs system, work has progressed toward integrating an In(x)Ga(1-x)As avalanche photodiode detector in a GaAs waveguide. In the Hg(x)Cd(1-x)Te-CdTe area an effort has been started to develop Hg(x)Cd(1-x)Te epitaxial growth techniques and waveguide, coupler, and acoustic frequency-shifter technology in CdTe. In a related program, Hg(x)Cd(1-x)Te photodiodes have been developed for heterodyne detection at 10.6 micrometers with a frequency cutoff of near 800 MHz and quantum efficiencies greater than 40 percent. GRA

N74-17482# Florida Univ., Gainesville. Dept. of Electrical Engineering.
SOLID STATE MATERIALS AND DEVICES
Fredrik A. Lindholm, Arthur J. Brodersen, Eugene R. Chenette, Sheng S. Li, and C. T. Sah 10 Apr. 1973 34 p refs
(Contract F19628-72-C-0368; ARPA Order 1060; AF Proj. 1060)
(AD-769962; AFCRL-TR-73-0529; SR-1) Avail: NTIS CSCL 20/12

Generalized hydrodynamic carrier transport equations for semiconductors are derived for materials having comparable scattering and generation-recombination-trapping-tunneling rates. Band-to-band radiative recombination in n-type gallium arsenide doped with oxygen is measured by photomagnetoelectric and photoconductive methods at 20.8K and 4.2K. These same methods of measurement are used to reveal the dependence of excess carrier lifetimes on photoinjected carrier densities in gallium arsenide doped with chromium. The existence of an interfacial layer is revealed and its effects characterized for a gold-gallium arsenide Schottky diode by measurement of the

current-voltage characteristics at very low reverse bias.
Author (GRA)

N74-17483# Illinois Univ., Urbana. Dept. of Physics.
ELECTRO-OPTICAL PROPERTIES OF SOLIDS Final Report, 1 Jan. 1971 - 31 Aug. 1973
Paul Handler 8 Nov. 1973 6 p refs
(Contract DAHC04-67-C-0025; Grant DA-ARO(D)-31-124-71-G21)
(AD-770456; AROD-6717-11-P) Avail: NTIS CSCL 20/12
Research on the electroreflectance of Germanium, Silicon and Gallium Arsenide is discussed. GRA

N74-17484# California Univ., Riverside.
CORRELATION EFFECTS IN HOPPING CONDUCTIONS CONDUCTION: A TREATMENT IN TERMS OF MULTI-ELECTRON TRANSITIONS
M. L. Knotek and M. Pollak 30 Mar. 1973 74 p refs
(Contract N00014-69-A-0200-5005)
(AD-769839) Avail: NTIS CSCL 20/12
The problem of impurity conduction at moderate compensation has been treated using the concept of multi-electron single-phonon transitions. The problem was treated in the region of density, temperature and compensation where two- (or many-) electron transitions begin to be important. A compensation of 0.5 is used with a temperature range of 1 K to 5 K and an average majority impurity separation of 200 to 600 in germanium. The problem is treated by comparing the transition rates of one- and multielectron transitions of the localized electron system where the one-electron transition defines the critical impedance in a percolation path at low densities and high temperatures. It is found that two and three electron effects may account for the lowering of the activation energy seen experimentally as the density of impurities is raised. Comparison to currently available experimental data is made. GRA

N74-17485# United Aircraft Corp., East Hartford, Conn. Research Labs.
SPUTTERED THIN FILM RESEARCH Semiannual Technical Report, 16 Apr. 1972 - 30 Sep. 1973
Alexander J. Shuskus, D. J. Quinn, E. L. Paradis, J. M. Berak, and D. E. Cullen Oct. 1973 58 p refs
(Contract N00014-72-C-0415; ARPA Order 2173)
(AD-769972; UARL-M951337; SATR-3) Avail: NTIS CSCL 09/1
Progress on the process development as it relates to the optical quality of sputtered single crystal films of ZnO, AlN, and TiO2 is discussed. Optical attenuation data for optical waveguide structures comprised of zinc oxide, aluminum nitride, titanium dioxide films grown on sapphire substrates and titanium dioxide on YZ cut lithium niobate is presented. The effect of depositon parameters on the carrier mobility of single crystal gallium arsenide films grown by reactive sputtering is presented. Author (GRA)

N74-17486# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1973:3 Quarterly Technical Summary, 1 May - 31 Jul. 1973
Alan L. McWhorter 30 Oct. 1973 76 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-770293; ESD-TR-73-236) Avail: NTIS CSCL 20/12
The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 May through Jul. 1973. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Physics of Solids, and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program.
Author (GRA)

N74-17487# Brandeis Univ., Waltham, Mass. Dept. of Chemistry.
MAGNETIC AND OPTICAL PROPERTIES OF TRANSITION METAL IONS IN SINGLE CRYSTALS Final Scientific Report, 1 Jun. 1969 - 1 Jun. 1972
Paul B. Dorain Oct. 1973 55 p refs
(Contract F33615-69-C-1727; AF Proj. 7885)
(AD-769870; ARL-73-0139) Avail: NTIS CSCL 07/4
The electrical, magnetic, and optical properties of a series of cubic single crystals of the K2PtCl6 type is reported. The results of the measurements of the conductivities of K2TaCl6, Rb2TaCl6, and Cs2TaCl6, together with the Nb analogues are presented. The optical spectra of Tc(-4) in Cs2ZrCl6 is reported, and a series of experiments on the exciton spectra of pure K2ReCl6 single crystals at 4.2K are discussed. The vibronic splitting of Ir(-4) Gamma 8 excited states as a function of the symmetric mode is also reported. Author (GRA)

N74-17488# Army Foreign Science and Technology Center, Charlottesville, Va.
STUDY OF POLARIZATION NONLINEARITY NEAR PHASE TRANSITIONS IN PEROVSKITE-TYPE FERROELECTRICS, USING AN ANHARMONIC MODEL
V. Ya. Fritsberg 19 Oct. 1973 17 p refs Transl. into ENGLISH of the Mono. "Fazove Perekhody v segnetoelektrikakh" Riga, 1971 17 p
(FSTC Proj. T7023012301)
(AD-770002; FSTC-HT-23-150-73) Avail: NTIS CSCL 20/12
A model of an anharmonic oscillator is applied to a unit cell of the perovskite structure. A microscopic representation for the coefficients A and B in the expansion of the form E = AP + B(P cubed) is found by the method of Boguslavskiy, and extended to the paraelectric state of the ferroelectric. Comparison is made with experimental data on the system (Ba,Sr)TiO3.
GRA

N74-17489# Northern Illinois Univ., Dekalb. Dept. of Physics.
ELECTRICAL AND OPTICAL PROPERTIES OF AMORPHOUS MATERIALS Final Semiannual Technical Report
Charles Wood 1973 272 p refs
(Grant DA-ARG(D)-31-124-72-G115; ARPA Order 1562)
(AD-770546; FSATR-6) Avail: NTIS CSCL 20/12
Research on Sb2Sn3 is reviewed covering spectroscopic studies of electron states of crystalline and amorphous forms, reflectivity and transmission measurements, photoemission, preparation and characterization of thin amorphous films, and thermopower and photothermopower measurements. Photoconductivity in antimony oxides is also discussed along with the Mossbauer effect of amorphous semiconductors and glasses.
GRA

N74-17490# RAND Corp., Santa Monica, Calif.
SOVIET RESEARCH ON SEMICONDUCTOR THIN FILMS: A SURVEY
George Rudins Feb. 1973 129 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-770606; R-1181-ARPA) Avail: NTIS CSCL 20/12
The report is divided into ten sections: the first two present an overview of Soviet work, section three discusses Soviet work on film deposition, the bulk of the Report (Sections four through eight) surveys studies of various film characteristics--e.g., structure and morphology, electrical, galvanomagnetic, acoustic, and optical properties, and quantum-size and space effects. Current work with polymer compounds--specifically, polydiphenylacetylene, copolymers at vinylidenfluoride with tetrafluoroethylene, pentacene, tetrathiotetracene, pinacyanol, phtalocyanin, and diphenylpolyene compounds--appears to be of significant interest. The remaining two sections of the Report discuss thin-film devices and application and film-measurement techniques. GRA

N74-17491# Hawaii Univ., Honolulu. Dept. of Physics and Astronomy.
LOW ENERGY X-RAY AND ELECTRON ABSORPTION WITHIN SOLIDS (100-150 eV REGION) Interim Report
Burton L. Henke and Eric S. Ebisu Aug. 1973 68 p refs
(Grant AF-AFOSR-2174-72; AF Proj. 9751)
(AD-770055; AFOSR-73-2027TR) Avail: NTIS CSCL 07/4
This report presents tables for the X-ray absorption coefficients (sq cm/gm units) for all elements and for twenty six of the most commonly applied characteristic wavelengths in ultrasoft X-ray measurement and in the 8-110 Angstrom region. These are based upon the best available theory and experiment. The current measurements and theory are reviewed and a complete bibliography of experimental measurements for the low energy region is presented. Included in these tables are the mass absorption coefficients for the special compound materials which are used in low energy X-ray measurement for thin film window systems and for proportional counter gases. Also presented here

are the self-absorption coefficients for the K alpha and L alpha radiations in this low energy X-ray region. A brief analysis of the deviation of the experimental data from the averaging table values is given for the light, medium and heavy element range. GRA

N74-17492# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
A CURRENT PULSE SCREENING TEST FOR METAL STEP COVERAGE Final Report, 30 Nov. 1971 - 15 Mar. 1973
Harold S. Gurev Nov. 1973 77 p
(Contract F29601-72-C-0018)
(AD-770699; AFWL-TR-73-107) Avail: NTIS CSCL 09/1

The project was undertaken to determine if single-shot electrical pulses of short duration (ZAP Testing) can be employed as an effective screening process for metallization defects which would significantly reduce current carrying capacity. The type of defect which is of primary concern at present is inadequate metal coverage over irregularities on a wafer surface - especially over a step cut into an oxide layer. (Metal coverage can be defined as the ratio of the minimum metal thickness over the surface irregularity to the thickness of metal on the adjoining flat surface.) GRA

N74-17493# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
WEAKLY-INTERACTING SINGLET-TRIPLET MAGNETIC SYSTEMS: APPLICATION TO COPPER NITRATE
Jill C. Bonner and Simeon A. Friedberg 20 Nov. 1973 8 p refs
(Contract N00014-67-A-0314-0006; NR Proj. 018-301)
(AD-770828; TR-12) Avail: NTIS CSCL 20/12

A series of studies in this laboratory has indicated that Cu(NO3)2.2.5H2O behaves approximately as an assembly of anti-ferromagnetically (AF) coupled pairs of Cu(2-) effective spin 1/2 ions. The Heisenberg binary pair system has a singlet ground state and a triplet excited state. Systematic discrepancies between theory and experiment have pointed to the necessity of including weak, AF, inter-pair interactions of a 1-D type. EPR studies have favored a magnetic ladder model structure. (Modified author abstract) GRA

N74-17410* Bell Telephone Labs., Inc., Holmdel, N.J.
IMAGE RECORDING USING CHARGE-COUPLED DEVICES
C. Sequin *In* NASA. Goddard Space Flight Center Advanced Electro-Opt. Imaging Tech. 1973 p 51-68 refs (For availability see N74-17406 08-23)
CSCL 20L

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-17494*# TRW Systems Group, Redondo Beach, Calif.
STUDY OF MONOPROPELLANTS FOR ELECTROTHERMAL THRUSTERS: ANALYTICAL TASK SUMMARY REPORT Interim Report, Mar. - Apr. 1973
J. D. Kuenzly and Rein Grabbi Dec. 1973 49 p
(Contract NAS5-23202)
(NASA-CR-132921; TRW-22409-6010-RU-00) Avail: NTIS HC $4.50 CSCL 21I

The feasibility of operating small thrust level electrothermal thrusters is determined with monopropellants other than MIL-grade hydrazine. The work scope includes analytical study, design and fabrication of demonstration thrusters, and an evaluation test program where monopropellants with freezing points lower than MIL-grade hydrazine are evaluated and characterized to determine their applicability to electrothermal thrusters for spacecraft attitude control. Results of propellant chemistry studies and performance analyses indicated that the most promising candidate monopropellants to be investigated are monomethylhydrazine, Aerozine-50, 77% hydrazine-23% hydrazine azide blend, and TRW formulated mixed hydrazine monopropellant (MHM) consisting of 35% hydrazine-50% monomethylhydrazine-15% ammonia. Author

N74-17495*# Aerojet Solid Propulsion Co., Sacramento, Calif.
A STUDY OF THE EFFECTS OF SOLID PHASE REACTIONS ON THE THERMAL DEGRADATION AND BALLISTIC PROPERTIES OF SOLID PROPELLANTS
Willfred G. Schmidt Feb. 1974 54 p refs
(Contract NAS1-11702)
(NASA-CR-132357) Avail: NTIS HC $5.75 CSCL 21I

The thermal stability of perchlorate composite propellants was studied at 135 and 170 C. The experimental efforts were concentrated on determining the importance of heterogeneous oxidizer-fuel reactions in the thermal degradation process. The experimental approach used to elucidate the mechanisms by which the oxidizer fuel composites thermally degrade was divided into two parts: (1) keeping the fuel constant and varying the nature of the oxidizers, and (2) holding the oxidizer constant and varying the fuel components. The fuel component primarily utilized in the first phase was polyethylene. Oxidizers included KClO4, KClO3, NH4ClO4 and NH4ClO4 doped with materials such as chlorate, phosphate and arsenate. In the second phase the oxidizer used was primarily NH4ClO4 while the fuels included saturated and unsaturated polybutadiene prepolymers and a series of bonding agents. Techniques employed in the current study include thermogravimetric measurements, differential thermal analysis, infrared, mass spectrometry, electron microscopy, and appropriate wet chemical analysis. Author

N74-17496*# Drexel Univ., Philadelphia, Pa.
CURRENT STATUS OF FREE RADICALS AND ELECTRONICALLY EXCITED METASTABLE SPECIES AS HIGH ENERGY PROPELLANTS Final Technical Report
Gerald Rosen Aug. 1973 69 p refs Revised Prepared for JPL
(Contracts NAS7-100; JPL-953623)
(NASA-CR-136938) Avail: NTIS HC $6.50 CSCL 21I

A survey is presented of free radicals and electronically excited metastable species as high energy propellants for rocket engines. Nascent or atomic forms of diatomic gases are considered free radicals as well as the highly reactive diatomic triatomic molecules that posess unpaired electrons. Manufacturing and storage problems are described, and a review of current experimental work related to the manufacture of atomic hydrogen propellants is presented. F.O.S.

N74-17497# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
DETERMINATION OF LIFETIME OF SOLID ROCKET PROPELLANTS. INFLUENCE OF BURNING MODERATORS ON THE CHEMICAL STABILITY OF DOUBLE BASE SOLID PROPELLANTS [DIE BESTIMMUNG DER LEBENSDAUER VON RAKETEN FESTTREIBSTOFFEN. DER EINFLUSS VON ABBRANDMODERATOREN AUF DIE CHEMISCHE STABILITAET VON DOUBLEBASE-FESTTREIBSTOFFEN]
F. Volk 30 Nov. 1972 56 p In GERMAN
(ICT-2/72) Avail: NTIS HC $6.00

The influence of surface dimensions on thermal degradation during isothermal storage between 60 and 90 deg of double base rocket propellants was determined. The influence of burning moderators (lead and copper solts of salicyclic, resorcyclic, and stearic acid) on the thermal stability of double base solid propellants was established through tests on model propellants. Samples with a large surface in general reach the autocatalytic degradation point sooner than compact samples. The degradation of ground propellants is faster than that of compact propellants. Copper salicylate was found to have a catalytic influence even at 75 deg. Lead stearate, lead salicylate, lead resorcylate, and lead ethylhexoate display a stabilizing effects. ESRO

N74-17498# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FUEL AND HYDROCARBON VAPORIZATION
Arthur Gauss Aug. 1973 61 p refs
(DA Proj. 1T1-61102-A-33E)
(AD-769709; BRL-1661) Avail: NTIS CSCL 07/4

A new semi-empirical expression has been developed which predicts the evaporation rates of pure liquid hydrocarbons under

a wide range of conditions. A code has been formulated which, using the above results, calculates the evaporation rates of binary mixtures of hydrocarbons. Extension of these results to real fuels is possible by finding the appropriate binary mixture which approximates the fuel. Analyses of the flammable envelopes surrounding pools of pure hydrocarbon and fuels have also been performed. Author (GRA)

N74-17499# Purdue Univ., Lafayette, Ind. Thermal Sciences and Propulsion Center.
STUDIES OF SLURRY FUELED PROPULSION SYSTEMS Semiannual Progress Report, 1 Aug. 1972 - 31 Jan. 1973
Bruce A. Reese and Harry M. Carbone Feb. 1973 27 p refs
(Contract N00014-67-A-0226-0013)
(AD-770041; TSPC-TM-73-4; SAPR-6) Avail: NTIS CSCL 21/4

The results of the experimental investigation of the combustion efficiencies of selected fuels, JP-4, JP-5, Decalin, 70% Tetralin/30% Decalin, and 75% Aluminum/25% Decalin, burned in two sudden dump combustors are presented and discussed. Author (GRA)

N74-17500# Georgia Inst. of Tech., Atlanta.
CATALYTIC BEHAVIOR IN COMPOSITE SOLID PROPELLANT COMBUSTION Annual Summary Report, 1 Sep. 1972 - 31 Aug. 1973
Warren C. Strahle, John C. Handley, and Narendra Kumar 1 Nov. 1973 136 p refs
(Contract N00014-67-A-0159-0016; NR Proj. 092-543)
(AD-770601) Avail: NTIS CSCL 21/9

The report describes experiments and theoretical analysis concerned with sandwich combustion. The ingredients used in the experiment are compacted polycrystalline ammonium perchlorate as the oxidizer, hydroxyl terminated polybutadiene as the binder and four catalysts; Harshaw catalyst CU-0202, Fe2O3, ferrocene, and iron blue. The pressure range studied is 600-2000 psia. The experimental techniques used are cinephotomacrography for sample observation during burning and burn rate determination, scanning electron microscopy for observation of quenched samples, and electron microprobing for an exploratory study of surface compositon. A theoretical solution to a simple sandwich deflagration problem is attained. The probable sites of catalytic activity are determined, results are compared with actual propellant experience, and the analysis is used to clarify experimental results. Author (GRA)

N74-17501# Rockwell International Corp., McGregor, Tex. Rocketdyne Div.
SOLID PROPELLANT COMBUSTION MODELING Interim Report
George D. Sammons Aug. 1973 11 p refs Presented at 10th JANNAF Combust. Meeting, Newport, R. I., 6-10 Aug. 1973
(Contract F44620-72-C-0046; AF Proj. 9711)
(AD-770682; AFOSR-73-2084TR) Avail: NTIS CSCL 21/9

The report covers the first 15 months of a continuing study on construction of a comprehensive mathematical model of composite solid propellant combustion, with emphasis on work during the past 12 months since reporting on the early efforts at the meeting last year. The liquid layer believed to exist on burning ammonium perchlorate has been treated in a manner similar to that described previously. Depth of penetration of a thermal wave is calculated and this value is multiplied by the surface area of oxidizer on the burning propellant surface. The surface is calculated in the computer program for use in other equations. Total volume of the liquid layer derived in this manner is then used to calculate the thermal contribution to surface temperature. (Modified author abstract) GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-17502*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY OF RECENT INVESTIGATIONS OF INLET FLOW DISTORTION EFFECT ON ENGINE STABILITY
Edwin J. Graber, Jr. and Willis M. Braithwaite 1974 21 p refs Presented at 12th Aerospace Sci. Meeting, Washington, D. C., 30 Jan. - 1 Feb. 1974; sponsored by AIAA
(NASA-TM-X-71505; E-7878) Avail: NTIS HC $3.25 CSCL 21E

A review is presented of recent experimental results, analytical procedures and test techniques employed to evaluate the effects of inlet flow distortion on the stability characteristics of representative afterburning turbofan and turbojet compression systems. Circumferential distortions of pressure and temperature, separately and in combination are considered. Resulting engine sensitivity measurements are compared with predictions based on simplified parallel compressor models and with several distortion descriptor parameters. Author

N74-17503*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN AERODYNAMIC STUDY OF SCRAMJET FUEL INJECTORS
Louis A. Povinelli 1974 26 p refs Proposed for presentation at Symp. on the Fluid Mech. of Combustion, Montreal, 13-16 May 1974; sponsored by ASME and Can. Soc. of Mech. Eng.
(NASA-TM-X-71504; E-7849) Avail: NTIS HC $3.50 CSCL 21E

The aerodynamic drag and fuel distribution patterns of injectors designed for a supersonic combustion ramjet were measured at Mach numbers of 2, 2.5, and 3. The most significant parameter effecting the drag was found to be the injector thickness ratio. A two-fold reduction in the thickness ratio caused a 65 percent decrease in drag. Changing the injector sweep angle a factor of 2 resulted in only a small change in drag. A reversal of injector sweep, from sweepback to sweepforward, did not change the measured drag. Helium gas was injected through the struts to simulate the penetration and spreading patterns of hydrogen. Sampling measurements were made at approximately 2 duct heights downstream of the combustor. The spacing required between fuel injectors was found to be about 10 jet diameters. The effect of gas injection on the measured drag was found to be minor. Author

N74-17504*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESULTS FROM CASCADE THRUST REVERSER NOISE AND SUPPRESSION EXPERIMENTS
O. A. Gutierrez, J. R. Stone, and R. Friedman 1974 38 p refs Presented at 12th Aerospace Sci. Meeting, Washington, D. C., 30 Jan. - 1 Feb. 1974; sponsored by AIAA
(NASA-TM-X-71500; E-7864) Avail: NTIS HC $4.00 CSCL 21E

Results from experimental work on model scale cascade reversers with cold airflow are presented. Sound power level directivity and spectral characteristics for cascade reversers are reported. Effect of cascade exit area ratio, vane profile shape, and emission arc are discussed. Model equivalent diameters varied from 3 to 5 inches, pressure ratios range from 1.15 to 3.0. Depending on the reverser type, acoustic power was proportional to the 4 1/2 to 6th power of ideal jet velocity. Reverser noise peaked at higher frequency and was more omnidirectional than nozzle-alone jet noise. Appreciable reduction in sideline noise was obtained from plane shields. Airfoil-vaned cascades were the most aerodynamically efficient and least noisy reversers. Scaling of cascade reverser data to example aircraft engines showed all cascades above the 95 PNdB sideline goal from STOL aircraft. However, the airfoil-vaned reverser has a good

potential for meeting this goal for high-bypass (low pressure ratio) exhausts. Author

N74-17505*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE OF A HYDROGEN BURNER TO SIMULATE AIR ENTERING SCRAMJET COMBUSTORS
William Roger Russin Washington Feb. 1974 58 p refs
(NASA-TN-D-7567; L-9363) Avail: NTIS HC $3.50 CSCL 21E

Tests were conducted to determine the performance of a hydrogen burner used to produce a test gas that simulates air entering a scramjet combustor at various flight conditions. The test gas simulates air in that it duplicates the total temperature, total pressure, and the volume fraction of oxygen of air at flight conditions. The main objective of the tests was to determine the performance of the burner as a function of the effective exhaust port area. The conclusions were: (1) pressure oscillations of the chugging type were reduced in amplitude to plus or minus 2 percent of the mean pressure level by proper sizing of hydrogen, oxygen, and air injector flow areas; (2) combustion efficiency remained essentially constant as the exhaust port area was increased by a factor of 3.4; (3) the mean total temperature determined from integrating the exit radial gas property profiles was within plus or minus 5 percent of the theoretical bulk total temperature; (4) the measured exit total temperature profile had a local peak temperature more than 30 percent greater than the theoretical bulk total temperature; and (5) measured heat transfer to the burner liner was 75 percent of that predicted by theory based on a flat radial temperature profile. Author

N74-17506*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME INJECTOR ELEMENT DETAIL EFFECTS ON SCREECH IN HYDROGEN-OXYGEN ROCKETS
Ned P. Hannum, Louis M. Russell, David W. Vincent, and E. William Conrad Washington Feb. 1974 41 p refs
(NASA-TM-X-2982; E-7512) Avail: NTIS HC $3.25 CSCL 21H

An experimental investigation was conducted to learn more about how the specific details of a concentric tube injection element affect the screech characteristics of a hydrogen-oxygen rocket engine. The four variables investigated were (1) impingement angle, (2) oxidizer tube blunt base thickness, (3) oxidizer tube recess and extension, and (4) oxidizer tube-annulus concentricity. Tests were made using a 27.34-cm (10.77-in.) diameter heat sink combustor at nominally 300-psia chamber pressure. All of the test variables were investigated using a 157 element circular pattern injector. Additional oxidizer tube recess tests were made with a 421 element hexagonal pattern injector. Tests were conducted over the oxidant-fuel ratio range of 4 to 6. Stability evaluation for each configuration was made using the hydrogen temperature rating technique. Several element configurations were also cold flow tested using nitrogen and water as simulants. The element detail changes resulted in changes in hydrogen injector pressure drop even though the physical injection area was constant for all similar tests in both hot firing and cold flow tests. These changes in injector pressure drop produced changes in combustion stability. The data were correlated with a modified version of a previously reported injection area ratio correlation. By interpreting changes in injector pressure drop as changes in injector hydrogen flow resistance, the data were compared with a hydrogen flow response stability model and were found to be in agreement. Author

N74-17507*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE INLET TEMPERATURE DISTORTION EFFECTS ON THE STALL LIMITS OF A J85-GE-13 TURBOJET ENGINE
Charles M. Mehalic and Roy A. Lottig Washington Feb. 1974 40 p refs
(NASA-TM-X-2990; E-7626) Avail: NTIS HC $3.25 CSCL 21E

The effects of circumferential and radial temperature distortions and combined temperature and pressure distortion on the performance of a J85-GE-13 turbojet engine were investigated. In terms of loss of compressor pressure ratio at stall, the most severe pattern of temperature distortion was hub radial while a circumferential pattern of diametrically opposed sectors was least severe. The effect of combined temperature and pressure distortion was dependent on the location of the high temperature and low pressure regions. The most serious stall pressure ratio losses occurred when these regions coincided. Author

N74-17508*# TRW Systems, Redondo Beach, Calif.
SOLAR ELECTRIC PROPULSION/INSTRUMENT/SUBSYSTEMS INTERACTION STUDY Final Report
J. M. Sellen, Jr., R. K. Cole, R. F. Kemp, D. F. Hall, and H. Shelton 30 Mar. 1973 152 p refs
(Contract NAS2-6940)
(NASA-CR-114732; TRW-22878-6007-RU-00) Avail: NTIS HC $10.75 CSCL 21C

The interactive effects between a solar electric propulsion system and an electrically propelled scientific spacecraft were examined. The operation of the ion thrusters may impact upon the acquisition and interpretation of data by the science payload of the spacecraft. The effluents from the operation of the electric propulsion unit may also impact upon the operation of the various subsystems of the vehicle. Specific interactive effects were isolated where meaningful levels of interaction may occur. The level of impact upon elements of the science payload and other affected subsystems is examined, and avenues for the reduction or elimination of impact are defined. Author

N74-17509*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR ARRAY STUDY FOR SOLAR ELECTRIC PROPULSION SPACECRAFT FOR THE ENCKE RENDEZVOUS MISSION
E. A. Sequeira and R. E. Patterson 1 Feb. 1974 87 p refs
(Contract NAS7-100)
(NASA-CR-136860; JPL-TM-33-668) Avail: NTIS HC $7.50 CSCL 21C

The work is described which was performed on the design, analysis and performance of a 20 kW rollup solar array capable of meeting the design requirements of a solar electric spacecraft for the 1980 Encke rendezvous mission. To meet the high power requirements of the proposed electric propulsion mission, solar arrays on the order of 186.6 sq m were defined. Because of the large weights involved with arrays of this size, consideration of array configurations is limited to lightweight, large area concepts with maximum power-to-weight ratios. Items covered include solar array requirements and constraints, array concept selection and rationale, structural and electrical design considerations, and reliability considerations. Author

N74-17510*# TRW Systems Group, Redondo Beach, Calif.
ELECTROSTATIC PROPULSION BEAM DIVERGENCE EFFECTS ON SPACECRAFT SURFACES, VOLUME 3 Final Report on Phase 4, Aug. 1971 - Aug. 1973
R. F. Kemp, D. F. Hall, and E. E. Luedke 15 Sep. 1973 156 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952350)
(NASA-CR-136933; TRW-11985-6003-RU-00) Avail: NTIS HC $11.00 CSCL 21C

Tests were conducted to determine the effects of electrostatic propulsion beam divergence effects on spacecraft surfaces. The subjects discussed are: (1) sensitive surfaces on the ATS 6 spacecraft, (2) the cesium ion source and testing facility, (3) cesium ion effects on thermophysical properties, and (4) simulated charge-exchange ion exposure. The compatibility of the ATS 6 ion engine experiment with the engineering subsystems and other experiments aboard the ATS 6 spacecraft was analyzed. Author

N74-17511*# Stanford Research Inst., Menlo Park, Calif.
DETERMINATION OF THE AVAILABILITY OF APPROPRIATE AGED FLIGHT ROCKET MOTORS
Patrick J. Martin 11 Jan. 1974 52 p Prepared for JPL
(Contracts NAS7-100; JPL-953298)
(NASA-CR-136864) Avail: NTIS HC $5.75 CSCL 21H

A program to identify surplus solid rocket propellant engines which would be available for a program of functional integrity testing was conducted. The engines are classified as: (1) upper

stage and apogee engines, (2) sounding rocket and launch vehicle engines, and (3) jato, sled, and tactical engines. Nearly all the engines were available because their age exceeds the warranted shelf life. The preference for testing included tests at nominal flight conditions, at design limits, and to establish margin limits. The principal failure modes of interest were case bond separation and grain bore cracking. Data concerning the identification and characteristics of each engine are tabulated. Methods for conducting the tests are described. Author

N74-17512# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
PROJECT SQUID Semiannual Progress Report, 1 Apr. - 30 Sep 1973
T. Adamson, F. Carta, P. Chung, J. Daiber, F. Fendell, J. Fenn, A. Fontijn, J. Howard, M. Lapp, S. Lederman et al 1 Oct. 1973 82 p refs
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-770045) Avail: NTIS CSCL 21/5

Reports of progress during the past six months on the 16 research programs comprising Project SQUID are presented. The research programs fall into the areas of Fluid Mechanics, Combustion and Molecular Processes, and Measurement Techniques. Project SQUID is a cooperative program of basic research related to jet propulsion. (Modified author abstract) GRA

N74-17513# TRW Systems Group, Redondo Beach, Calif.
PULSED PLASMA PROPULSION TECHNOLOGY Final Report, 3 Apr. 1972 - 30 Jul. 1973
C. Lee Dailey and Harold A. Davis Jul. 1973 76 p ref Prepared in cooperation with Capacitor Specialists, Inc., Escondido, Calif.
(Contract F04611-72-C-0050; AF Proj. 3058)
(AD-770527; AFRPL-TR-73-81) Avail: NTIS CSCL 21/3

An experimental investigation was conducted with two separate objectives. One was the demonstration of 30% efficiency with the pulsed inductive plasma thruster; the other was the development of energy storage capacitors capable of delivering 10 to the 8th power pulse discharges at an energy storage density of 40 joules per pound. The latter objectives was met with a paper-K film dielectric sandwich impregnated with castor oil and an extended foil capacitor construction. The former objective was not met although substantial progress was made by the use of preionization prior to the capacitor discharge. The thruster employed a 30 cm diameter flat spiral coil to induce a plasma current sheet in the propellant when a 675 joule capacitor bank (15 kv) was discharged through it. The propellant was a layer of gas injected in a thin layer over the coil by a fast-acting gas valve. Both argon and xenon were investigated. (Modified author abstract) GRA

N74-17514# Gottingen Univ. (West Germany).
INITIATION, STABILITY AND LIMITS OF DETONATION FOR ADVANCED STABLE/AIR-BREATHING AND HYBRID PROPULSION ENGINE DESIGN Final Report
W. Jost and G. Wagner 31 Jul. 1973 27 p refs
(Grant AF-AFOSR-2146-71; AF Proj. 9711)
(AD-770070; AFOSR-73-1991TR) Avail: NTIS CSCL 21/5

During this period research was carried out on the influence of initial conditions on limits of detonability in hydrocarbon-air mixtures, with emphasis on the influence of detonation tube shape. Experimental results for circular cross-section tubes indicated that the detonation limit is a linear function of reciprocal tube diameter. For square cross-section tubes experimental results obtained seem to indicate that the limits of detonability are slightly wider than for circular, and neither hydraulic radius, tube area, or narrowest tube dimension determines limits of detonability. However, measurements in rectangular tubes with various cross sections seem to indicate that for rectangular cross section tubes there exists a very close correlation between the limits of detonability and the narrowest hydraulic diameter of the tube, as long as one side is not too narrow. (Modified author abstract) GRA

N74-17515# ARO, Inc., Arnold Air Force Station, Tenn.
DESIGN ASSURANCE TEST OF THE THIOKOL TE-M-521-5 APOGEE KICK MOTOR TESTED IN THE SPIN MODE AT SIMULATED ALTITUDE CONDITIONS Final Report
J. O. Brooks and H. L. Merryman AEDC 1 Jun. 1973 50 p refs Sponsored by AEDC
(AD-770013; ARO-ETF-TR-73-170; AEDC-TR-73-170) Avail: NTIS CSCL 21/8

One solid-propellant rocket motor was successfully fired at an average simulated altitude of about 103,000 ft while spinning at 46 rpm. The general program objectives were to verify compliance of motor performance with the manufacturer's specifications. Specific primary objectives were to determine vacuum ballistic performance of the motor after prefire vibration conditioning and temperature conditioning at 40F, altitude ignition characteristics, motor structural integrity, and motor temperature-time history during and after motor operation. Additional objectives were to measure the lateral (monaxial) thrust component during motor operation and to measure radiation heat flux in the vicinity of the nozzle exit plane. Author (GRA)

N74-17516# Massachusetts Inst. of Tech., Cambridge. Turbine Lab.
INVESTIGATION OF FACTORS AFFECTING HEAT TRANSFER TO TURBINE END WALLS Final Report, 26 Oct. 1970 - 26 Aug. 1973
Jean F. Louis Oct. 1973 42 p refs
(Contract F33615-71-C-1016; AF Proj. 3066)
(AD-769878; AFAPL-TR-73-93) Avail: NTIS CSCL 21/5

Short duration studies of heat transfer and film cooling effectiveness were made using a shock tunnel and a turbine blowdown facility. These facilities use the concept of short duration experiments to test turbines or turbine components under steady-state conditions which scale the metal operating temperatures down to room temperature, and subsequently scale pressures and mass flow rates so that Reynolds and Mach numbers are kept unchanged. Since the Prandtl number remains the same, the Nusselt number is also unchanged. The short operating time assures that the surfaces remain nearly isothermal and that fast instrumentation, pressure transducers and heat transfer gauges can be used to record average and unsteady pressures and heat transfer in this more amenable environment. The problem of primary concern is the heat transfer and cooling of stationary rotor shrouds (engine seals). (Modified author abstract) GRA

N74-17517# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYTICAL STUDY OF ICING SIMULATION FOR TURBINE ENGINES IN ALTITUDE TEST CELLS Final Report, Jun. 1971 - Jun. 1972
C. E. Willbanks and R. J. Schulz AEDC Nov. 1973 97 p refs
(AD-770069; ARO-ETF-TR-73-59; AEDC-TR-73-144) Avail: NTIS CSCL 21/5

An analytical study of simulated icing for turbine engines in altitude test cells was made. A mathematical model of a typical direct-connect type of icing test cell was developed and the governing equations were programmed for computer solution on FORTRAN computer language. A parametric study was performed to determine the effects of the test cell inlet and water spray conditions on the thermodynamic and kinetic state of the flow in the test section or at the engine compressor face. The importance of correctly simulating droplet size distribution, mean effective droplet diameter, liquid water content, and humidity was investigated. The results of the investigation lend further support to the fact that ground test facilities provide the best capability for conducting turbine engine icing tests. The ability to define and control the simulated environment gives an altitude test cell distinct advantages not enjoyed by flight testing in natural icing environments or flight testing in artificial environments created by tanker aircraft. Author (GRA)

N74-17518# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
HOLOGRAPHIC INVESTIGATION OF ELECTROSTATIC SPRAYING Ph.D. Thesis
Philip Eugene Stover Jun. 1973 116 p refs
(AF Proj. 3141)
(AD-770264; AFAPL-TR-73-8) Avail: NTIS CSCL 21/3

Holography was used to investigate the microscopic phenomena in the vicinity of the tip of a metal capillary that was electrostatically spraying a conducting liquid. The capillary was

0.014 inch in diameter and the voltage of the capillary relative to its surroundings was varied from 5 to 7 kv. The liquid sprayed was sodium iodide doped glycerol. Holograms were made with a pulsed ruby laser and reconstructed with a helium-neon laser. The spray was found to originate on the surface of the liquid as well as around the rim of the capillary. Calculations of electric field strength on the axis of the needle indicated that the field of the liquid surface was probably high enough to induce spraying. (Modified author abstract) GRA

N74-17519# RAND Corp., Santa Monica, Calif.
TECHNOLOGICAL CHANGE THROUGH PRODUCT IMPROVEMENT IN AIRCRAFT TURBINE ENGINES
Robert Shishko May 1973 88 p refs
(Contract F44620-73-C-0011; Proj. RAND)
(AD-769911; R-1061-PR) Avail: NTIS CSCL 21/5

An area of R and D activity often as important as new product R and D is R and D directed at improving an existing object, often called product improvement. Multiple regression techniques were used to estimate a multi-dimensional technology tradeoff surface for U.S. aircraft turbine engines. Product-improvement engines embody a higher level of technology than their original versions, but the rate of technological advance is significantly less than the long-run average for new designs. Further, thrust-growth product improvement is subject to diminishing returns with respect to dollar resources. (Modified author abstract) GRA

N74-17520# ARO, Inc., Arnold Air Force Station, Tenn.
A LITERATURE REVIEW ON TURBINE COMBUSTOR MODELLING AND EMISSIONS Final Report, 1 Jul. 1972 31 Mar. 1973
I. T. Osgerby AEDC Nov. 1973 42 p refs
(ARO Proj. RD231)
(AD-770260; ARO-ETF-TR-73-103; AEDC-TR-73-163) Avail: NTIS CSCL 21/5

The rapidly growing body of literature on turbine combustor modelling is reviewed. The analytical models are presented and discussed with particular emphasis placed on their ability to predict gross operating characteristics as well as pollutant emission levels. Comparison is made between theory and engine and laboratory experiments showing the general inaccuracies of current models. A suggestion for improvement of the best available model is made, and areas for fundamental research are pointed out. Author (GRA)

N74-17521# Auburn Univ., Ala. Dept. of Mechanical Engineering.
PERFORMANCE OF GAS-AUGMENTED WATER JET PROPULSION SYSTEM Final Report, Mar. 1972 - Sep. 1973
T. T. Maxwell, J. F. Stansell, G. Maples, and D. F. Dyer Sep. 1973 150 p refs
(Contract N00014-72-C-0177)
(AD-770896) Avail: NTIS CSCL 13/10

The report describes an investigation of the performance of a gas-augmented waterjet propulsion system. The study was divided into three parts. First, an analytical investigation was conducted to determine the performance of air-augmented waterjet thrust nozzles. Also, comparisons were made between equations from the literature for the local sonic velocity and the sonic velocity predicted by the analysis. An experimental investigation was performed to determine the validity of the model development in the first part. The agreement between analysis and experiment was good for low air-water ratios. The third part of the report describes a study used to estimate the overall performance of a gas-augmented propulsion system. Several parameters were varied to determine their effect upon the performance. Author (GRA)

N74-17522# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Lab.
THE LOW HUB-TIP RATIO SUPERSONIC AXIAL-FLOW COMPRESSOR, VOLUME 3 Final Report, 1 Jul. 1971 - 30 Jun. 1972
Frans A. E. Breugelmans Dec. 1972 105 p refs
(Grant AF-AFOSR-2104-71; AF Proj. 7065)
(AD-770648; VKI-IN-42-Vol-3; ARL-73-0169-Vol-3) Avail: NTIS CSCL 21/5

The report describes the test results of a supersonic axial-flow compressor stage with a tip Mach number of 2.0. Volume 2 discusses a method to eliminate the inlet problem. Volume 3 describes the overall and detailed performance of the original model FB 3 with an interblade row bleed system. The bleed area represents 10% of the inlet area and a minimum bleed flow of 7% of the total inlet flow could be achieved. The stage performance data are presented for the 60% to 107% N over the square root of theta of the nominal speed. Author (GRA)

N74-17523# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
PERFORMANCE OF ARMY ENGINES WITH LEADED AND UNLEADED GASOLINE. PHASE 1: LABORATORY TESTING Interim Report
J. A. Russell, J. D. Tosh, A. A. Johnston, J. V. Moffitt, and C. A. Moses Jan. 1973 135 p refs
(Contract DAAD05-72-C-0427)
(AD-766760; AFLRL-21) Avail: NTIS CSCL 21/7

Six different types of Army engines were endurance tested on dynamometers for 125 hr each, using three grades of military Federal specification gasoline having typical conventionally leaded, low-lead, and unleaded concentrations of lead antiknock additives, respectively. All six engine types performed satisfactorily on all gasoline blends from the standpoints of (1) catastrophic failure, (2) excessive valve or cylinder wear, (3) engine power output and fuel and oil consumption, and (4) emissions degradation. (Modified author abstract) Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-17524 Maryland Univ., College Park.
AN ANALYSIS OF TYPE 3 BURST POSITIONS Ph.D. Thesis
Thomas Bernardus Henricus Kuiper 1973 167 p
Avail: Univ. Microfilms Order No. 73-28866

A new technique has been devised to determine the variation of the position of Type 3 bursts with frequency as we would observe it outside the ionosphere. This intrinsic variation of position with frequency is compared with the variation of coronal electron density with height, on the assumption of the plasma hypothesis. The good agreement suggests that the positions of bursts near the limb are not seriously affected by scattering in the corona, and that the temperature in regions of Type 3 activity is not notably different from the average coronal temperature. The height of Type 3 bursts is determined with improved accuracy. The problems of determining a density from this datum are discussed. Dissert. Abstr.

N74-17525*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR COSMIC RAY COMPOSITION ABOVE 10 MeV/NUCLEON AND ITS ENERGY DEPENDENCE IN THE 4 AUGUST 1972 EVENT
D. L. Bertsch, S. Biswas, and D. V. Reames Jan. 1974 31 p refs Submitted for publication
(NASA-TM-X-70590; X-662-74-32) Avail: NTIS HC $4.75 CSCL 03B

Observations of the proton, helium (C,N,O) and Fe-group nuclei fluxes made during the large 4 August 1972 solar particle event are presented. The results show a small, but significant variation of the composition of multicharged nuclei as a function of energy in the energy region above 10 MeV/nucleon. In particular, the He/(C,N,O) abundance ratio varies by a factor approximately 2 between 10 and 50 MeV/nucleon, and the Fe-group/(C,N,O) ratio suggests a similar variation. Abundance ratios from the 4 August 1972 event are compared as a function of energy with ratios measured in other solar events. At energies approximately greater than 50 MeV/nucleon, the

He/(C,N,O) abundance ratio for August 1972 is consistent with all earlier measurements made above that energy. Author

N74-17526*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SECONDARY ELECTRON BACKGROUND PRODUCED BY HEAVY NUCLEI IN A MULTIWIRE PROPORTIONAL COUNTER HODOSCOPE
S. H. Morgan, Jr., J. W. Watts, Jr., H. Schwille, and U. Pollvogt
Washington Feb. 1974 48 p refs
(NASA-TN-D-7591; M-462) Avail: NTIS HC $.25 CSCL 14B

The secondary electron background produced by heavy nuclei in a multiwire proportional counter hodoscope is calculated using both a simplified and a more complete Monte Carlo model. These results are compared with experimental data from a small multiwire proportional counter hodoscope operated in a 530 MeV/nucleon accelerator beam of nitrogen nuclei. Estimates of the secondary electron background produced by heavy relativistic nuclei are presented along with the detailed results from calculations of energy deposition in the hodoscope counter cells. Author

N74-17527# Argonne National Lab., Ill.
SOLAR ENERGY EVALUATION GROUP REPORT
Aug. 1973 48 p refs
(Contract W-31-109-eng-38)
(ANL-8045) Avail: NTIS HC $4.00

A partial reviews of the status of various phases of solar-energy utilization and of some of the areas of potentially profitable research is reported. The review covers the biological and in vitro aspects of the photochemical conversion of solar energy; the photovoltaic, photothermal, and thermoelectric studies of the physical-conversion process; the use of solar energy for heating and cooling buildings; and the central-station power approach. Author (NSA)

N74-17528# Office of Naval Research, London (England).
CRITICAL PROBLEMS IN SOLAR FLARE RESEARCH COSPAR 1973 Conference Report
Arthur H. Waynick 16 Aug. 1973 12 p refs Conf. held at Konstanz, West Germany, 23 May - 6 Jun. 1973
(AD-770124; ONRL-C-18-73) Avail: NTIS CSCL 03/2

The report discusses solar flare research and outlines certain critical problems in this field which require solution to permit further progress in it. The subjects covered include: the physics of flare formation; the observation of flare phenomena on the sun, interplanetary space and the earth; classification of flares; and, solar flare forecasting. (Modified author abstract) GRA

N74-17338 World Meteorological Organization, Geneva (Switzerland).
THE SOLAR CONSTANT
In its Radiation Processes in the Atmosphere 1972 p 1-16 refs (For availability see N74-17337 08-20)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-17529 Florida Univ., Gainesville.
FLUID DYNAMICS OF CIRCUMSTELLAR MATERIAL ASSOCIATED WITH Be STARS Ph.D. Thesis
Thomas Harlow Morgan 1973 193 p
Avail: Univ. Microfilms Order No. 73-29196

Temporal and angular variations in the motion and distribution of circumstellar material about typical Be stars are studied by means of a simple hydrodynamical approach. The validity of any hydrodynamical study of the dynamics of the envelope is examined, and the problem is found to lie within the realm of hydrodynamics for typical disk conditions. The problem is, however, close to the limit of validity of that discipline. Further, Euler's equation may be used as the equation of motion throughout most of the gaseous disk surrounding the central star. Each flow variable is written as the sum of a known steady-state axially-symmetric term and an unknown term containing the temporal and angular dependence. The squares of these latter quantities are assumed small. Using this, the equations of motion and continuity are reduced to a set of linear equations for the terms with temporal and angular dependence. Dissert. Abstr.

N74-17530 Oregon Univ., Eugene.
UNIFORM COSMOLOGICAL MODELS INCLUDING BOTH MATTER AND RADIATION WITH A NON-RESTRICTED COSMICAL CONSTANT Ph.D. Thesis
James Peter Matthesen 1973 96 p
Avail: Univ. Microfilms Order No. 73-28615

The theoretical predictions of cosmological models conforming to the uniformity postulate are investigated. Secondly, a model of radio source evolution is developed which allows a quantitative analysis of the evolution required to satisfy the radio source number count data for each cosmological model. Cosmological models considered are those satisfying the general relativistic field equations, the uniformity postulate, and containing both matter and radiation with no restrictions on either the cosmical constant or the curvature index. Model ages, travel times of radiation, and horizons are determined. These, as well as the luminosity vs. redshift and the angular diameter vs. redshift relations are computed numerically and compared with observation. The observational data includes that of ordinary galaxies, radio galaxies, and quasars. This comparison eliminates all models except those in a finite volume of parameter space.
Dissert. Abstr.

N74-17531 New York Univ., N.Y. School of Engineering and Science.
A NUMERICAL MODEL FOR THE CIRCULATION OF THE LOWER ATMOSPHERE OF VENUS Ph.D. Thesis
Edward Barry Feinberg 1973 156 p
Avail: Univ. Microfilms Order No. 73-28547

Starting from the basic equations of fluid dynamics, a numerical model is developed which can be used to investigate the circulation of the lower atmosphere of Venus. The equations are scaled for circulation in a vertical plane, with pressure as the vertical coordinate and distance from the subsolar point as the horizontal coordinate. The equations are written in nondimensional form. The dependent variables are temperature, vorticity, and stream function. Three physical quantities characterize the model: mean surface pressure, mean temperature, and the horizontal scale of the circulation. A steady state form of the model is derived and then linearized. A sufficient condition for linearization to be valid is that the large scale Reynolds number is of order 0.1 or less. Linearization can also be valid if the streamlines form approximately second degree closed concentric curves, such as ellipses. Dissert. Abstr.

N74-17532 California Univ., Los Angeles.
ITERATIVE TECHNIQUES FOR THE DETERMINATION OF RENDEZVOUS TRAJECTORIES IN THE PRESENCE OF PERTURBATIONS Ph.D. Thesis
Gary Randall Smith 1973 140 p
Avail: Univ. Microfilms Order No. 73-28980

The problem of rendezvous in the presence of n-body gravitational perturbations is studied using three different iterative techniques. Gauss-Jackson numerical integration formulas are used to integrate the equations of motion for the method of variations of parameters with the variables a, b, n, M. Several alternatives are presented for the determination of Sigma x sub 0 and sigma squared x sub 0 in the Gaussian numerical integration starting procedure. The minor planet 1620 Geographos is used as a test object. The interception of Geographos with the earth during the time of its 1994 close approach is studied. Integration of Geographos past its 1983 close approach with the earth is also discussed. The three iterative techniques are tested on the node to node transfer in 1994. Computer timing estimates and program sizing estimates are provided. Several recommendations for additional research are given.
Dissert. Abstr.

N74-17533 California Univ., San Diego.
A STUDY OF HARD X-RAY EMISSIONS FROM SUPERNOVA

REMNANTS Ph.D. Thesis
John George Laros 1973 101 p
Avail: Univ. Microfilms Order No. 73-25412

Four young supernova remnants--the Crab Nebula, SN 1572 (Tycho's Nova), Cas A, and the result of a recent explosion in M101 -- were observed in the 15-300 keV range from balloons in September and October of 1970. The observations employed an actively shielded scintillation-type X-ray telescope having a sensitive area of 34.2 square centimeters and a 5.6 FWHM. Spectra of the total Crab Nebula and the Crab Pulsar NP 0532 were obtained, with the region of highest accuracy being the 25-150 keV range. It is shown that mono-energetic electron injection can also produce a reasonable spectrum whose shape is determined by the configuration of the nebular magnetic field and the evolution of NP 0532. It is generally agreed that a pulsar is a rotating neutron star with a strong non-axisymmetric magnetic field. Dissert. Abstr.

N74-17534*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
CRITICAL CONFIGURATIONS (DETERMINANTAL LOCI) FOR RANGE AND RANGE DIFFERENCE SATELLITE NETWORKS
Emmanuel Tsimis Jan. 1973 159 p refs
(Grant NGR-36-008-093; OSURF proj. 2514)
(NASA-CR-136943; DGS-191) Avail: NTIS HC $11.00 CSCL 22C

The observational modes of Geometric Satellite Geodesy are discussed. The geometrical analysis of the problem yielded a regression model for the adjustment of the observations along with a suitable and convenient metric for the least-squares criterion. The determinantal loci (critical configurations) for range networks are analyzed. An attempt is made to apply elements of the theory of variants for this purpose. The use of continuously measured range differences for loci determination is proposed. Auhtor

N74-17535# European Southern Observatory, Santiago (Chile).
[RESEARCH ON GALACTIC STRUCTURE, STAR CLUSTERS, MAGELLANIC CLOUDS, AND VARIED TELESCOPE PROJECTS] Annual Report, 1972
1972 87 p refs
Avail: NTIS HC $6.50

Research activities at the European Southern Observatory (ESO) are reported in these areas: galactic structure, star clusters, and Magellanic clouds. Telescope projects include: the 3.6m telescope project, the Schmidt telescope, and the Danish national 1.5m telescope project. A list of ESO libraries is included along with a meteorological report and a discussion of the ESO sky survey project and Sky Atlas Laboratory. K.M.M.

N74-17536*# National Aeronautics and Space Administration, Washington, D.C.
PHILOSOPHY AND PHYSICAL THEORY
M. V. Mosterpanenko Feb. 1974 431 p refs Transl. into ENGLISH of the publ. "Philosfiya i Fisicheskaya Teoriya" Leningrad, Nauka, 1969 p 1-239 Sponsored in part by NSF
(NASA-TT-F-15403; TT-71-53148) Avail: NTIS HC $23.75 CSCL 03B

The influence of philosophy on physics is discussed. Topics discussed include: conception of the physical picture of the world and the problem of origin of physical theories; mechanical picture of the world and the first stage in the development of physical theories; origin of the electrodynamic picture of the world and the second stage in the development of the physical theory; and quantum-field picture of the world and third stage in the development of physical theories. It is shown that the problem of origin and development of physical theory must be decided in close association with the problem of origin and development of physical pictures of the world, which is connected directly with philosophy. F.O.S.

N74-17537*# Stanford Univ., Calif. Center for Systems Research.
INVESTIGATION OF HALO SATELLITE ORBIT CONTROL Final Report
John V. Breakwell Oct. 1973 8 p refs
(Grant NGR-05-020-507)
(NASA-CR-132858) Avail: NTIS HC $3.00 CSCL 22C

Calculations are given for Halo satellite orbit control. Previous truncated analytical descriptions were limited and lead to an acceleration error averaging about .000001, which is the 'cost' of a very tight control to the nominal path. The stationkeeping problem is posed so as to permit a looser, optimal three-axis control. K.M.M.

N74-17538*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
UNMANNED SURFACE TRAVERSES OF MARS AND MOON: SCIENCE OBJECTIVES, PAYLOADS, OPERATIONS
Leonard D. Jaffe and Raoul Choate (TRW Systems Group, Redondo Beach, Calif.) 8 Jun. 1973 41 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Spacecraft and rockets in June 1974
(Contract NAS7-100)
(NASA-CR-136810) Avail: NTIS HC $4.25 CSCL 03B

Science objectives and properties to be measured are outlined for long surface traverse missions on Mars and the Moon, with remotely-controlled roving vehicles. A series of candidate rover payloads is proposed for each planet, varying in weight, cost, purpose, and development needed. The smallest weighs 35 kg; the largest almost 300 kg. A high degree of internal control will be needed on the Mars rover, including the ability to carry out complex science sequences. Decision-making by humans in the Mars mission includes supervisory control of rover operations and selection of features and samples of geological and biological interest. For the lunar mission, less control on the rover and more on earth is appropriate. Science portions of the rover mission profile are outlined, with timelines and mileage breakdowns. Operational problem areas for Mars include control, communications, data storage, night operations, and the mission operations system. For the moon, science data storage on the rover would be unnecessary and control much simpler. Author

N74-17539*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DYNAMICS AND COLUMN DENSITIES OF SMALL PARTICLES EJECTED FROM SPACECRAFT
Robert J. Naumann Washington Feb. 1974 37 p
(NASA-TN-D-7590; M-460) Avail: NTIS HC $3.00 CSCL 22C

Trajectories and relative motions of small particles ejected from a spacecraft were analyzed, and modifications to the clearing times and column densities because of orbital dynamics were assessed. It was found that despite the fact that such particles are confined by orbital dynamics to move along similar trajectories with the spacecraft rather than to continue their free expansion, the effect is negligible for viewing angles away from the orbital path. Small particles are rapidly swept away by drag and will not contribute significantly to the column density when viewing along the velocity vector in 420-km earth orbit. However, substantial increases in column density can results when viewing in a direction opposite to the velocity vector because of drag effects. In the absence of drag, significant column densities can build up both in front of and behind the spacecraft in earth orbit for particles released at a few meters per second. This effect is much less pronounced in lunar orbit because the same release velocity produces a larger orbital perturbation for the particle. Author

N74-17540*# Analytical Mechanics Associates, Inc., Los Angeles, Calif.
RADIO ASTRONOMY EXPLORER-B IN-FLIGHT MSSION CONTROL SYSTEM DEVELOPMENT EFFORT Final Report
D. A. Lutsky, W. S. Bjorkman, and C. Uphoff Mar. 1973 166 p refs
(Contract NAS5-11900)
(NASA-CR-132924; Rept-73-8) Avail: NTIS HC $11.50 CSCL 22C

A description is given of the development for the Mission Analysis Evaluation and Space Trajectory Operations (MAESTRO) program to be used for the in-flight decision making process during the translunar and lunar orbit adjustment phases of the flight of the Radio Astronomy Explorer-B. THe program serves two functions: performance and evaluation of preflight mission

analysis, and in-flight support for the midcourse and lunar insertion command decisions that must be made by the flight director. The topics discussed include: analysis of program and midcourse guidance capabilities; methods for on-line control; printed displays of the MAESTRO program; and in-flight operational logistics and testing. Author

N74-17541*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A CONCEPTUAL DESIGN AND OPERATIONAL CHARACTERISTICS FOR A MARS ROVER FOR A 1979 OR 1981 VIKING SCIENCE MISSION
Wayne L. Darnell and Vernon W. Wessel Washington Feb. 1974 89 p refs
(NASA-TN-D-7462; L-9254) Avail: NTIS HC $4.00 CSCL 22B

The feasibility of a small Mars rover for use on a 1979 or 1981 Viking mission was studied and a preliminary design concept was developed. Three variations of the concept were developed to provide comparisons in mobility and science capability of the rover. Final masses of the three rover designs were approximately 35 kg, 40 kg, and 69 kg. The smallest rover is umbilically connected to the lander for power and communications purposes whereas the larger two rovers have secondary battery power and a 2-way very high frequency communication link to the lander. The capability for carrying Viking rovers (including development system) to the surface of Mars was considered first. It was found to be feasible to carry rovers of over 100 kg. Virtually all rover systems were then studied briefly to determine a feasible system concept and a practical interface with the comparable system of a 1979 or 1981 lander vehicle. Author

N74-17542*# Northrop Services, Inc., Huntsville, Ala.
STATISTICAL ANALYSIS OF FLIGHT TIMES FOR SPACE SHUTTLE FERRY FLIGHTS
M. E. Graves and M. Perlmutter Jan. 1974 41 p refs
(Contract NAS8-21810)
(NASA-CR-129021) Avail: NTIS HC $5.25 CSCL 22A

Markov chain and Monte Carlo analysis techniques are applied to the simulated Space Shuttle Orbiter Ferry flights to obtain statistical distributions of flight time duration between Edwards Air Force Base and Kennedy Space Center. The two methods are compared, and are found to be in excellent agreement. The flights are subjected to certain operational and meteorological requirements, or constraints, which cause eastbound and westbound trips to yield different results. Persistence of events theory is applied to the occurrence of inclement conditions to find their effect upon the statistical flight time distribution. In a sensitivity test, some of the constraints are varied to observe the corresponding changes in the results. Author

N74-17543*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GALACTIC ARM STRUCTURE AND GAMMA RAY ASTRONOMY
G. F. Bignami and C. E. Fichtel Jan. 1974 14 p refs Submitted for publication
(NASA-TM-X-70589; X-662-74-31) Avail: NTIS HC $4.00 CSCL 03A

Unexpectedly high energy gamma radiation over a broad region of the galactic plane in the general direction of the galactic center was observed. A model is proposed wherein the galactic cosmic rays are preferentially located in the high matter density regions of galactic arm segments, as a result of the weight of the matter in these arms tieing the magnetic fields and hence the cosmic rays to these regions. The presently observed galactic gamma ray longitudinal distribution can be explained with the current estimate of the average galactic matter density: if the average arm to interarm matter ratio is five to one for the major arm segments toward the galactic center from the sun; and if the cosmic ray density normalized to its local value is assumed to be directly proportional to the matter density. Author

N74-17544*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MILLISECOND TEMPORAL STRUCTURE IN CYG X-1
R. E. Rothschild, E. A. Boldt, S. S. Holt, and P. J. Serlemitsos Dec. 1973 13 p refs Submitted for publication
(NASA-TM-X-70583; X-661-73-393) Avail: NTIS HC $4.00 CSCL 03A

Evidence is presented for the X-ray variability of Cyg X-1 on time scales down to a millisecond. Several bursts of millisecond duration are observed. The duty cycle for bursting is estimated to be approximately greater than .0002 averaged over the entire 49. second exposure, although the maximum burst activity is associated with a region of enhanced emission lasting about 1/3 second. Such bursts may be associated with turbulence in disk accretion at the innermost orbits for a black hole. Author

N74-17545# Groupe de Recherches de Geodesie Spatiale, Paris (France).
BULLETIN OF THE GROUPE DE RECHERCHES DE GEODESIE SPATIALE, NO. 9 [BULLETIN DU GROUPE DE RECHERCHES DE GEODESIE SPATIALE, NO. 9]
Jul. 1973 53 p refs In FRENCH; ENGLISH summaries
(GRGS-Bull-9) Avail: NTIS HC $4.75

Results of the Trapol experiment for the determination of earth pole coordinates using single station Doppler observations are reported. The limiting magnitude of stars for the Antares camera when used in tracking mode is discussed. For individual titles, see N74-17546 through N74-17547.

N74-17546 Observatoire de Paris-Meudon (France).
TRAPOL EXPERIMENTAL RESULTS: DETERMINATION OF THE POLE USING SINGLE STATION DOPPLER OBSERVATIONS [RESULTATS DE L'EXPERIENCE TRADPOL. DETERMINATION DU POLE PAR DES OBSERVATIONS DOPPLER EN UNE SEULE STATION] c13
Nicole Capitaine *In* Groupe de Rech. de Geodesie Spatiale Bull. No. 9 Jul. 1973 p 1-31 refs In FRENCH; ENGLISH summary (For availability see N74-17545 08-30)

Results obtained from the Trapol experiment to determine polar motion with only one Doppler station observing a single satellite, the orbit of which was given by the Naval Weapons Laboratory, are reported. The results obtained were the station coordinates in the DPMS earth-fixed reference frame and the instantaneous variation of the latitude of the Bretigny tracking station during a short period in a reference frame bound to the earth's rotation axis. These results show that it is possible to obtain the latitude variation of one Doppler station observing a single satellite with better precision than using an astrolabe, provided the orbit taken as reference is above the tracking station. ESRO

N74-17547 Observatoire de Paris-Meudon (France).
LIMITING MAGNITUDE FOR THE ANTARES CAMERA IN THE TRACKING MODE [SUR LA MAGNITUDE-LIMITE DANS L'EMPLOI DE LA CAMERA ANTARES EN POURSUITE]
P. Muller *In* Groupe de Rech. de Geodesie Spatiale Bull. No. 9 Jul. 1973 p 32-48 refs In FRENCH; ENGLISH summary (For availability see N74-17545 08-30)

In order to transfer the Nice tracking station to the Calern Plateau site, the limit-magnitude of a star for the Antares satellite-camera when used in tracking mode was defined. Owing to the number and diversity of factors involved, the investigation was conducted on an experimental basis using a set of photographic plates of the Diademe, Simultan, and Isagex campaigns and available astronomical catalog data. It is shown that the choice of the Calern Plateau site will improve the magnitude gain and therefore the yield and quality of Antares camera results. ESRO

N74-17548# California Univ., Livermore. Lawrence Livermore Lab.
INTERNATIONAL CONFERENCE ON PHOTONUCLEAR REACTIONS AND APPLICATIONS, PROCEEDINGS, VOLUME 1
Barry L. Berman, ed. 1973 714 p refs Conf. held at Pacific Grove, Calif., 26-30 Mar. 1973 Sponsored by AEC, NSF, Army, Navy
(Conf-730301-P1-Vol-1) Avail: NTIS HC $27.20 (2 vol. set)

An overview of recent ideas is presented concerning stellar evolution, nucleosynthesis, and the fate of stars. Emphasis is

placed on the nuclear aspects, especially nuclear photodisintegration which for purposes of this review means processes having a photon in either the entrance or the exit channel.
Author (NSA)

N74-17549# California Univ., Livermore. Lawrence Livermore Lab.
INTERNATIONAL CONFERENCE ON PHOTONUCLEAR REACTIONS AND APPLICATIONS, PROCEEDINGS, VOLUME 2
Barry L. Berman, ed. 1973 678 p refs Conf. held at Pacific Grove, Calif., 26-30 Mar. 1973 Sponsored by AEC, NSF, Army, Navy
(Conf-730301-P2-Vol-2) Avail: NTIS HC $27.20 (2 vol. set)

The nuclear, radiation and chemical factors that may cause serious errors in photoactivation of F in chondritic meteorites are discussed. In chondrites the activated F appears to become labile and may be lost. The method is applied without difficulty to terrestrial rock standards, achondrites and lunar samples, all of which are of igneous origin. F contents of lunar samples are given and the implications regarding volatiles on the moon are discussed. Author (NSA)

N74-17550# Mons Univ. (Belgium). Dept. d'Astrophysique.
[RESEARCH ACTIVITIES OF THE DEPARTMENT OF ASTROPHYSICS] Annual Report, 1972
L. Houziaux 1973 19 p refs
(Commun-36) Avail: NTIS HC $4.00

Activities in the field of stellar atmospheres, observations of early-type stars, star charts, and catalogs are examined, along with data analysis on wavelength shifts of He-2 ion resonance line due to plasma polarization. ESRO

N74-17551# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS OF THE ORBIT OF 1970-65D, COSMOS 259 ROCKET
Doreen M. C. Walker Aug. 1973 30 p refs
(RAE-TR-73110; BR36622) Avail: NTIS HC $4.50

The orbit of Cosmos 359 was determined by optical tracking at 42 epochs during its lifetime of 410 days, using the RAE refinement program, PROP. The orbit enabled the atmospheric rotational speed to be determined from the decrease in orbital inclination. The air density at heights near 200 km was valuated from the decay rate. Upper atmosphere zonal winds and 15th-order harmonics in the geopotential were also evaluated from the changes in orbital inclination. ESRO

N74-17552# Royal Aircraft Establishment, Farnborough (England).
RESONANCE EFFECTS IN DECAYING SATELLITE ORBITS, AND THEIR USE IN STUDIES OF THE GEOPOTENTIAL
D. G. King-Hele May 1973 16 p refs Presented at the 1st Intern. Symp. on the Use of Artificial Satellites for Geodesy and Geodyn., Athens, May 1973
(RAE-TM-SPACE-196; BR36383) Avail: NTIS HC $4.00

The procedure for obtaining geopotential coefficients from the observed charges in orbital parameters is summarized, and recent numerical results are given. An orbital parameter, the inclination, and one resonance of the 15th order are discussed. ESRO

N74-17553# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MINIMIZATION OF PERTURBANCE EFFECTS ON A HIGH ECCENTRICITY, HIGHLY INCLINED 24-HOUR SATELLITE ORBIT M.S. Thesis
Allen L. Thede Jun. 1973 110 p refs
(AD-769964; GA/MC/73-7) Avail: NTIS CSCL 22/3

A study was performed to analyse and minimize the effects of the perturbative forces on a 24-hour satellite orbit having an eccentricity of 0.6 and an inclination of 60 degrees by selection of an optimum launch date. The computer model used includes the perturbations due to the oblate earth as described by the zonal, tesseral and sectorial harmonic series through sixth order, the solar and lunar third-body forces, and the solar radiation pressure on a vehicle whose area-to-mass ratio is 10 ft squared/slug. The orbit was computed for one year following launch with oribital parameter variations presented as functions of the launch date during 1970. The results of the study indicate that the total required impulse is significantly dependent on the launch date and oscillatory behavior of the orbital parameters due to the lunar-cycle. (Modified author abstract) GRA

N74-17554# Naval Academy, Annapolis, Md.
COSMIC RAY TRAJECTORIES IN LOCAL MAGNETIC FIELDS
Michael J. Gouge 21 May 1973 90 p refs
(AD-769508; USNA-TSPR-44) Avail: NTIS CSCL 03/2

Several investigators have noticed sidereal and diurnal variations in the cosmic ray flux reaching the earth. The latter may be explained by periodic changes in the interplanetary magnetic field. The sidereal variations could possibly be produced by discrete galactic sources of cosmic ray particles. In order to investigate this effect the trajectories of 10 GeV particles arriving at the earth vertically at Annapolis, Maryland were numerically traced back through the terrestrial and interplanetary magnetic fields. It is found that the trajectory of an experimental maximum flux at 19 hours RA extrapolates backwards to the general direction of the galactic center for a variety of interplanetary sector magnetic field configurations. This indicates that discrete sources, most of which are located at the galactic center, could be responsible for the sidereal variations and the observed maximum flux at 19 hours RA. These results further suggest that the interplanetary magnetic field is not a randomizing field, as several previous investigators have indicated. Author (GRA)

N74-17555# Naval Academy, Annapolis, Md.
AN ANALYSIS OF POLARIZATION DATA FOR LATE-TYPE GIANT AND SUPER GIANT STARS
Louis H. Knotts 21 May 1973 152 p refs
(AD-769510; USNA-TSPR-46) Avail: NTIS CSCL 03/2

This investigation constitutes an indepth study of the intrinsic polarization of late type giant and supergiant stars, which will better define the relationships that exist between polarization percentages and other known physical parameters. During the investigation a suitable method of polarimetry was developed and this method was put to use for the detection of stellar polarization. Polarization data was also collected from other reference sources for stars within the spectral region M1 to M6, and this data was examined for suspected relationships with temperature and infrared radiation. The data was also studied with respect to several parameters for which a correlation is not expected, specifically: apparent magnitude, distance, and magnetic field strength. (Modified author abstract) GRA

N74-17556# Naval Research Lab., Washington, D.C. Operations Research Branch.
SECULAR STABILITY OF RAPIDLY ROTATING STARS OF ARBITRARY STRUCTURE Final Report
Zdenek Kopal 4 Oct. 1973 35 p refs
(RR0030241)
(AD-769520; NRL-7620; OR-73-2) Avail: NTIS CSCL 03/3

The report uses Poincare's criteria to investigate the secular stability of self-gravitating configurations of arbitrary structure in the state of rapid rotation. The potential energy, a knowledge of which is necessary for application of these criteria, has been determined by an extension of Clairaut's method, and its evaluation in terms of suitably chosen generalized coordinates carried out explicitly to quantities of fourth order in superficial oblateness, for configurations of arbitrary internal structure. The method employed can, moreover, clearly be extended to attain accuracy of any order, at the expense of mere manipulative work which lends itself to machine automation. The angular velocity of axial rotation can be an arbitrary function of position as well as of the time. An application of the results to homogeneous configurations in rigid-body rotation was undertaken to demonstrate that the method, when applied to a case for which a closed solution exists, leads to results which are consistent with it. Author (GRA)

N74-17557# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
MOONRISE, MOONSET AND MOON PHASES FOR 1973
George M. Fugate and Lamar Newman Dec. 1972 24 p refs
(DA Proj. 1T6-65702-D-127)

(AD-769248; DR-745) Avail: NTIS CSCL 03/1

Contents: Times of moonrise, moonset and moon phases at White Sands Missile Range; Use of solar-lunar charts and declination tables; Equinoxes and solstices, 1973; Illumination due to the moon; Times of moonrise, moonset and moon phases for 1973. GRA

N74-17558# Owens Valley Radio Observatory, Pasadena, Calif.

APERTURE SYNTHESIS STUDY OF HI IN THE GALAXY IC10

G. S. Shostak 1973 23 p refs

(Contract N00014-67-A-0094-0019)

(AD-770594; Rept-1973-15) Avail: NTIS CSCL 03/2

Synthesis observations of the neutral hydrogen in the partially obscured, irregular galaxy IC10 are presented. Angular resolution is 2 minutes arc and spectral resolution is 21 km/s. The data are consistent with a flattened gas distribution undergoing general rotation. Evidence is presented which suggests that the obscuration in the direction of IC10 has been overestimated. Author (GRA)

N74-17559# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

SOLAR RADIO ACTIVITY IN AUGUST 1972 Interim Report

John P. Castelli, William R. Barron, and Jules Aarons 24 Jan. 1973 37 p refs

(AF Proj. 4643)

(AD-762205; AFCRL-TR-73-0086; AFCRL-PSRP-532) Avail: NTIS CSCL 03/2

A wide variety of both conventional and infrequently observed phenomena took place during the disk passage of McMath Plage No. 11976. A summary of the more important solar radio activity is presented. The largest of the bursts on 2, 4, and 7 August had proton association which is correlated quantiatively with burst integrated flux density. One of the events was visible in white light and also had an associated ground level event. The spectra of the largest bursts are considered. As early as 31 July 1972, many unusual bursts at wavelengths shorter than 3 cm were observed as point brightenings with excellent X-ray association. Though discussions are at times presented, the emphasis of this report is on presentation of data. (Modified author abstract) GRA

N74-17560# Smithsonian Astrophysical Observatory, Cambridge, Mass.

INVESTIGATION OF INFRARED STELLAR SPECTRA WITH HIGH-RESOLUTION INSTRUMENTATION Final Report, 1 Apr. 1970 - 31 Mar. 1973

Lawrence Mertz 31 Mar. 1973 70 p refs

(Contract F19628-70-C-0253)

(AD-763107; AFCRL-TR-73-0298) Avail: NTIS HC $3.00 CSCL 03/2

Several infrared stellar spectra have been measured with about 0.5/cm resolution in the ranges 4100 to 5100 and 5400 to 6400/cm. The presence of OH absorption lines has been identified on them, and the rotational structure of the CO molecular absorption bands is easily resolved. The high resolution and high accuracy, deriving from Fourier spectrometry, permit distinctions between stellar and telluric absorptions on the basis of Doppler shifts. Many unidentified stellar features are evident in the spectra of long-period variables. The investigation required development of a Fourier spectrometer system and data-processing techniques, the details of which are presented here. Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N74-17561*# Chrysler Corp., New Orleans, La. Data Management Services.

STATIC STABILITY AND CONTROL EFFECTIVENESS OF MODELS 12-0 AND 34-0 OF THE VEHICLE 3 CONFIGURATION, VOLUME 2

E. C. Allen (Rockwell Intern., Huntsville, Ala.) and T. Tuttle (Rockwell Intern., Downey, Calif.) Aug. 1973 1065 p 3 Vol. (Contract NAS9-13247)

(NASA-CR-128780; DMS-DR-2055-Vol-2) Avail: NTIS HC $56.25 CSCL 22B

Static stability and control effectiveness characteristics of two 0.004 scale models of the vehicle 3 configuration are presented. The components investigated consisted of a single aft body, vertical/rudder, OMS pods with two interchangeable wings, four interchangeable forward bodies, four trimmers, and a spoiler. The test was conducted in a 14 x 14 inch trisonic wind tunnel over a Mach number range from 0.6 to 4.96. Angles of attack from 0 to 60 degrees and angles of sideslip from -10 to 10 degrees at 0, 10, 20, 30, and 40 degrees angle of attack were tested. Elevon, body flap, and speed brake deflection composed the parametric considerations. No grit was placed on the models during the test. The lateral-directional characteristics are presented along with some additional longitudinal data. Author

N74-17562# Committee on Aeronautical and Space Sciences (U. S. Senate).

SPACE SHUTTLE PAYLOADS, PART 2

Washington GPO 1973 104 p refs Hearing before Comm. on Aeron. and Space Sci., 93d Congr., 1st Sess., 31 Oct. 1973 Avail: SOD HC $1.00

The hearings are reported, concerning the space shuttle payloads. The sortie mode for both free and attached payloads, and the design concepts for satellite solar power stations are discussed. The economic aspects of the solar power stations are also discussed. For Part 1, see N74-15533. F.O.S.

N74-17563*# Weston Instruments, Inc., College Park, Md. EMR Div.

IMP I, H, AND J Final Report

Nov. 1973 399 p

(Contract NAS5-11211)

(NASA-CR-132926) Avail: NTIS HC $21.00 CSCL 22C

The schedule for the IMP project for the eighth, ninth, and tenth satellites of the series is presented. A description of the spacecraft and the weekly summaries of the operations performed on the spacecraft are provided. The project planning, project problems, recommendations, and reports of launch operations are described. Drawings of the satellite structures are included. Author

N74-17564*# EMR Aerospace Sciences, College Park, Md.

IMP J SUMMARY TECHNICAL REPORT

Dec. 1973 29 p

(Contract NAS5-11211)

(NASA-CR-132932) Avail: NTIS HC $4.50 CSCL 22B

The IMP J Summary Technical Report provides technical and administrative guidance for design, fabrication, integration, testing, and prelaunch activity on future spacecraft programs. General problems encountered on the IMP J program are described, and a recommendation is offered for these problems on future programs. Author

N74-17565*# Operations Research, Inc., Silver Spring, Md.

ON BOARD SATELLITE PROCESSING STUDY Final Report

D. L. Reed May 1973 107 p refs

(Contract NAS5-21645)

(NASA-CR-132931; TR-771) Avail: NTIS HC $8.50 CSCL 22B

The use of satellite-based, world-wide data collection and location systems for scientific purposes is discussed. The configuration of satellite borne data handling equipment to prevent premature saturation and to provide maximum capacity without degradation of performance is described. An analysis of a data collection and location system based on random time and frequency access to the satellite was conducted. The subjects

presented are: (1) a general description of the concept of a random access system, (2) the quantitative characteristics of random access systems, and (3) the development of a model for comparing the various types of digital communications systems. Author

N74-17566*# General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
ATLAS F ENTRY AEROTHERMIC STUDY Final Report
Dec. 1972 167 p refs Sponsored in part by NASA
(Contract F04701-72-C-0054)
(NASA-CR-132409; GDCA-BGJ72-017) Avail: NTIS HC $11.50 CSCL 22B

The feasibility of obtaining heat transfer data on an expended Atlas F booster launch vehicle was investigated in the altitude range of 300,000 to 200,000 feet during entry conditions, with a velocity in the range of 20,000 to 25,000 feet per second, and through a range of vehicle attitudes of plus or minus 90 degrees. These data are desired for correlation with turbulent heat transfer and boundary layer transition data obtained from wind tunnel test facilities. The data would also be valuable in assessing rarified gas and surface catalicity effects in a real gas environment. Author

N74-17567*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
TECHNOLOGY REQUIREMENTS FOR COMMUNICATION SATELLITES IN THE 1980'S Final Report
J. E. Burtt, C. R. Moe, R. V. Elms, L. A. DeLateur, W. C. Sedlacek, and G. G. Younger Oct. 1973 329 p refs
(Contract NAS2-7073)
(NASA-CR-114680) Avail: NTIS HC $19.50 CSCL 22B

The key technology requirements are defined for meeting the forecasted demands for communication satellite services in the 1985 to 1995 time frame. Evaluation is made of needs for services and technical and functional requirements for providing services. The future growth capabilities of the terrestrial telephone network, cable television, and satellite networks are forecasted. The impact of spacecraft technology and booster performance and costs upon communication satellite costs are analyzed. Systems analysis techniques are used to determine functional requirements and the sensitivities of technology improvements for reducing the costs of meeting requirements. Recommended development plans and funding levels are presented, as well as the possible cost saving for communications satellites in the post 1985 era. Author

N74-17568*# Martin Marietta Corp., Denver, Colo.
HEAT TRANSFER AND PRESSURE DISTRIBUTIONS AT M EQUALS 8 ON 0.029 SCALE MODELS OF THE VIKING ENTRY VEHICLE
R. Faye-Petersen, D. Sarver, and H. Carroll Jul. 1972 156 p refs
(Contract NAS1-9000)
(NASA-CR-132413; TP-3720318) Avail: NTIS HC$11.00 CSCL 22B

An investigation in the Langley Research Center Mach-8 Variable Density Hypersonic Tunnel was made of the pressure distributions and heat transfer rate distributions on two 0.029 scale Viking Entry Vehicle models. Comparable ranges of test Reynolds number were exercised for the two tests between run conditions around 4 million and conditions of about 1.6 million. At angles of attack less than 20 degrees the pressure ratio distribution referended to stagnation pressure appeared invariant with Reynolds number. Increasing angle of attack results in a flatter distribution of both the windward and leeward pressure distributions; in addition, the stagnation point shifted into the windward plane. A subsequent rise in the heating rate profile on the leeward side with further increase in angle of attack is attributed to boundary layer natural transition to turbulent flow. Schlieren photographs were taken for flow field visualization and to correct model angle of attack. Author

N74-17569*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 11
R. H. Spangler (Rockwell Intern.) Oct. 1973 819 p
(Contract NAS9-13247)
(NASA-CR-128794-Vol-11; DMS-DR-2032-Vol-11) Avail: NTIS HC $44.00 CSCL 22B

Tests were conducted in wind tunnels during April and May 1973, on an 0.030-scale replica of the Space Shuttle Vehicle Configuration 2A. Aerodynamic loads data were obtained at Mach numbers from 0.6 to 3.5. The investigation included tests on the integrated (launch) configuration and on the isolated orbiter (entry configuration). The integrated vehicle was tested at angles of attack from -15 degrees to +40 degrees and angles of sideslip from -10 degrees to +10 degrees as dictated by trajectory considerations. The effects of orbiter/external tank incidence angle and deflected control surfaces on aerodynamic loads were also investigated. Tabulated pressure data are presented for: orbiter fuselage and base, upper MPS nozzle, OMS nozzle, body flap, OMS pod outside, and lower wing surface. Author

N74-17570*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF TESTS OA12 AND IA9 IN THE AMES RESEARCH CENTER UNITARY PLAN WIND TUNNELS ON AN 0.030-SCALE MODEL OF THE SPACE SHUTTLE VEHICLE 2A TO DETERMINE AERODYNAMIC LOADS, VOLUME 12
R. H. Spangler (Rockwell Intern.) Oct. 1973 1179 p
(Contract NAS9-13247)
(NASA-CR-128794-Vol-12; DMS-DR-2032-Vol-12) Avail: NTIS HC $58.50 CSCL 22B

Tabulated pressure data are presented for: upper wing surface, left and right verticle tail surfaces, APU inlet, SRM booster and booster base, and external tank and tank base. For complete abstract, see N74-17569.

N74-17571*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APOLLO SATURN 511 EFFLUENT MEASUREMENTS FROM THE APOLLO 16 LAUNCH OPERATIONS: AN EXPERIMENT
Gerald L. Gregory, William C. Hulten, and Dewey E. Wornom Washington Mar. 1974 16 p
(NASA-TM-X-2910; L-9097) Avail: NTIS HC $3:00 CSCL 22D

An experiment was performed in conjunction with the Apollo 16 launch to define operational and instrumentational problems associated with launch-vehicle exhaust effluent monitoring. Ground and airborne sampling were performed for CO, CO2, hydrocarbons, and particulates. Sampling systems included filter pads and photometers for particulates and whole-air grab samples for gases. Launch debris was identified in the particulate samples at ground level(taken immediately after launch) and in the airborne measurements (taken 40 to 50 minutes after launch approximately 40 km downwind of the pad). Operational problems were identified and included the need for higher instrumentation mobility and the need for real-time sampling instrumentation as opposed to collection-type samples such as the whole-air grab sample. Author

N74-17572*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMICS OF FLEXIBLE SPINNING SATELLITES WITH RADIAL WIRE ANTENNAS
R. W. Longman and J. V. Fedor Sep. 1973 33 p refs
(NASA-TM-X-70584; X-732-73-233) Avail: NTIS HC $4.75 CSCL 22B

A dynamic analysis is presented for a spin stabilized spacecraft employing four radial wire antennas with tip masses, a configuration first employed in the IMP-J spacecraft. The use of wires in place of the usual booms represents the ultimate in weight reduction at the expanse of flexibility. The satellite is modelled as a 14 degree of freedom system, and the linearized equations of motion are found. The lowest order vibrational modes and natural frequencies of the gyroscopically coupled system are then determined. Because the satellite spin rate is decreased by antenna deployment, a spin-up maneuver is needed. The response of the time varying mode equations during spin-up is found, for the planar modes, in terms of Bessel functions and a Struve function of order -1/4. Because tables of the latter are not

readily available, the particular solution is expressed in various forms including an infinite series of Bessel functions and a particularly useful asymptotic expansion. Author

N74-17573*# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
EVALUATION OF A METAL FUSELAGE PANEL SELECTIVELY REINFORCED WITH FILAMENTARY COMPOSITES FOR SPACE SHUTTLE APPLICATION Final Report
W. F. Wennhold Jan. 1974 217 p refs
(Contract NAS1-10766)
(NASA-CR-132380) Avail: NTIS HC $14.00 CSCL 22B

The use of high strength and modulus of advanced filamentary composites to reduce the structural weight of aerospace vehicles was investigated. Application of the technology to space shuttle components was the primary consideration. The mechanical properties for the boron/epoxy, graphite/epoxy, and polyimide data are presented. Structural testing of two compression panel components was conducted in a simulated space shuttle thermal environment. Results of the tests are analyzed. Author

N74-17574# National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY, FEBRUARY 1973
Oct. 1973 89 p refs
Avail: NTIS HC $7.50

Daily cloud photographs from the Tiros Operational Satellite (NOAA 2) are presented. The photographs include both the Northern and Southern Hemispheres. A brief description of the methods used in preparing the photographs is presented, with emphasis upon the scanning radiometer, hemispheric and daily mosaics, and computerized techniques for organizing the photographs. S.K.W.

N74-17575# European Space Operations Center, Darmstadt (West Germany). Spacecraft Attitude Branch.
SYSTEMS ASPECTS OF THE DIGITAL SIMULATION OF SATELLITES AS REQUIRED FOR THE DEVELOPMENT AND TEST OF THE GROUND SUPPORT SOFTWARE
Rolf E. Muench 1973 27 p Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.50

Aspects of the setting-up of a digital simulation system, which supports the development and tests of ground support software systems, are presented. Sensor and actuator characteristics, measurement and transmission errors, suitable dynamical model, normal and abnormal behavior, and back-up procedures are emphasized. Various categories of simulation systems used for topics such as testing of mathematical methods, data handling and task management, and closed-loop performance (satellite/ground support software), are highlighted. Examples are given which illustrate simulation concepts evolved from ESRO projects, such as TD1A, ESRO 4, and Cos B. ESRO

N74-17576# British Aircraft Corp. (Operating) Ltd., Bristol (England).
THE HYBRID SIMULATION OF A DUAL-SPIN SPACECRAFT
C. Edgcombe, J. A. Holt, and N. Swift 1973 40 p refs Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $5.00

The methods adopted to derive a simulation of a mutating dual spin spacecraft are discussed; the simulation is to be as complete as possible but with minimum computational complexity. Included in the model are: inertial asymmetry of platform and rotor; static and dynamic imbalance; nonrigid despin bearing; fuel slosh on the rotor; and platform mounted nutation damper. Care was taken in the modeling of dissipative phenomena (such as fuel slosh) to maintain maximum physical realizability. In deriving the equations of motion of the system (which consists of five coupled rigid bodies), it was found convenient to consider the motion of each body separately under the influence of interactive constraint forces and moments imposed by the other bodies. Author (ESRO)

N74-17577# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Div.
PROBLEMS OF OBSERVER DESIGN
E. Bruederle, J. L. Santana, and H. Weingarten 1973 22 p refs Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.25

Methods for adapting an observer-controller combination to handle deterministic but unknown disturbances are discussed. The principles are applied to the attitude control of a geostationary satellite under the influence of constant friction torques and constant and sinusoidally varying solar pressure torques. Equations of motion of a satellite with internal reaction wheels are standard examples of a system which is bilinear in states and inputs. Large parameter variations in the transition matrix of the bilinear system are also considered. Author (ESRO)

N74-17578# Louvain Univ. (Belgium).
ESTIMATION OF SATELLITE DYNAMICS BY MEANS OF NONLINEAR FILTERING
P. Y. Willems 1973 16 p refs Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.00

The orientation of a deformable spacecraft is estimated by means of a nonlinear filter. The equations for this filter are inspired by the linearized equations of the complete system. It appears that the number of modes must be limited if the filter is to operate rapidly and use limited computer memory space. At the same time, the choice of a mean reformer frame permits a simplification of the nonlinear filter and physical visualization. ESRO

N74-17579# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
SELECTION OF MATERIALS AND COMPONENTS FOR SPACECRAFT
Walter Wilkens 1973 39 p refs Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $5.00

Some general aspects are outlined for identifying spacecraft materials and components requirements selection procedures related to functional and environmental capabilities. Problems with the application and extrapolation of existing data are pointed out, emphasizing materials outgassing and contamination. Screening and qualification tests are referred to and results on tests with a black thermal control paint for Helios satellite are given. These results refer to thermooptical, electrical, outgassing, and contamination properties as well. Author (ESRO)

N74-17580# Engins Matra, Velizy (France).
MATHEMATICAL MODELS WITH HYBRID COORDINATES USED FOR DYNAMIC SIMULATION OF GEOSTATIONARY SATELLITES WITH FLEXIBLE SOLAR PANELS [MODELES MATHEMATIQUES A COORDONNEES HYBRIDES UTILISES EN SIMULATION DYNAMIQUE DES SATELLITES GEOSTATIONNAIRES EQUIPES DE PANNEAUX SOUPLES SOLAIRES]
P. Vohan and S. A. EnginsMatra 1973 20 p In FRENCH Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.00

Mathematical models are described along with the development of equations governing the dynamics of a geostationary satellite with flexible solar panels. The dynamic models will be used for the simulation of these satellites in North-South configurations. The models were used to study the interface between attitude control and flexible panels for solar panel data corresponding to output powers of 1 to 4 kw. The panel structures were scanned to cover the range of possible structures (deployable and roll-up types). ESRO

N74-17581# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Automatique.
DIGITAL CONTROL OF TELECOMMUNICATIONS SATELLITE [PILOTAGE NUMERIQUE DES SATELLITES DE TELECOMMUNICATIONS]
J.-F. LeMaitre and C. Reboulet 1973 31 p refs In FRENCH

Presented at the Intern. Seminar on Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.75

The stabilization system for a telecommunication satellite based on a gimballed inertial wheel is described. This system provides attitude control during the orbital correction phases which expose the satellite to excessive perturbation moments with a permanent phase. The inertial wheel configuration suspended by gimbals has the advantage of an electric actuation and estimation of yaw angle by the gimbal joint angle. Proposed formulas are directly related to the sampled system technique, so that sampling frequency can be minimized. Simulation has made it possible to verify and even find the real functioning of the system in regard to nonlinear phenomena due to dry friction couples. Hybrid simulation allows the development of software for an onboard stabilization computer. ESRO

N74-17582# Centre d'Etudes et de Recherches, Toulon (France). Dept. d'Etudes et de Recherches en Automatique.
VALIDITY CONDITIONS OF MATHEMATICAL MODEL SIMULATION [CONDITIONS DE VALIDITE D'UNE SIMULATION PARMODELE MATHEMATIQUE]
J.-F. LeMaitre 1973 9 p In FRENCH Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $4.00

Concepts of the theories of mathematical models and of systems are discussed and applied to simulation of Meteosat and communication satellite attitude control. Objective criteria for evaluating the validity of a simulation were obtained. It is pointed out that simulation of a system leads to two successive operations: choice of a mathematical model and a simulation method. A degree of liberty is introduced resulting in several possible solutions leading to different performances. ESRO

N74-17583# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Automatique.
CONTROL OF SPACE LAUNCHERS
J. P. Jung and L. LeLetty 1973 45 p refs Presented at the Intern. Seminar Simulation and Space, Toulouse, 10-14 Sep. 1973
Avail: NTIS HC $5.25

Control laws for launch vehicles for large spacecraft were investigated by minimizing a quadratic performance index or by modal control. Parametric optimization methods were determined for a launch vehicle with bending; propellant sloshing was disregarded. A dynamic compensator is proposed based on modal control according to Pearson's method. The compensator was derived from simplified equations of the vehicle (without bending), and extended to the flexible vehicle in the presence of selective filters. This method can be extended to the whole vehicle and certain filtering problems may be eliminated. Calculations were based on the Diamant launch vehicle. ESRO

N74-17584# Royal Aircraft Establishment, Farnborough (England).
TABLE OF EARTH SATELLITES. VOLUME 2. PART 4: 1972
J. A. Pilkington (Scarborough Planetarium, Engl.), D. G. King-Hele, and H. Hiller Jul. 1973 55 p refs
(RAE-TR-73070; BR36334) Avail: NTIS HC $5.75

All known artificial satellites launched between 1 January 1972 and 31 December 1972 are listed chronologically. Lifetimes, weights, dimensions and orbital details are given for instrumented satellites and then final-stage rockets. The methods used in compiling the table are described. ESRO

N74-17585# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
COMPARISONS BETWEEN EXPERIMENT AND AN APPROXIMATE TRANSONIC CALCULATIVE METHOD
Donald J. Spring 25 Sep. 1973 43 p refs
(DA Proj. 1M2-62303-A-214)
(AD-770363; RD-73-34) Avail: NTIS CSCL 19/7

A method has been developed by Wu and Aoyama (1) to predict the surface pressures over tangent ogive bodies at zero angle of attack. To verify the usefulness and the accuracy of the method, an experimental program was conducted over the Mach number range between 0.7 and 1.2. The data obtained during the test program are in the form of pressure coefficients and are presented as plots of surface pressure distribution over the body. (Modified author abstract) GRA

N74-17586# Aerospace Corp., El Segundo, Calif.
RECOMMENDATIONS CONCERNING SPACECRAFT CHARGING IN THE MAGNETOSPHERE
David P. Cauffman 31 Aug. 1973 39 p refs
(Contract F04701-73-C-0074)
(AD-770591; TR-0074(9260-09)-5; SAMSO-TR-73-348) Avail: NTIS CSCL 22/2

At synchronous-orbit altitudes in the earth's magnetosphere, dark insulated surfaces of a spacecraft normally change to negative potentials in excess of several volts. During magnetospheric substorms, potentials may exceed many kilovolts. Anomalies in the performance of spacecraft systems have been indirectly linked to charging, allegedly through (1) electromagnetic interference from discharges, (2) surface damage by discharges, or (3) contamination enhancement by electrostatic deposition. This report examines the evidence that charging causes these effects and discusses (1) measures that can be taken to eliminate charging and its unwanted effects (Electrostatic cleanliness requirements), (2) instrumentation that can detect the occurrence of charging, and (3) research and instrumentation needed to parameterize the problem in order to develop optimal specifications for preventing anomalies in future systems. Author (GRA)

N74-17587# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PRELIMINARY CONFIGURATION DESIGN OF A MODULAR WEAPON WITH CANARD CONTROLS M.S. Thesis
Wendell R. Hull Jun. 1973 97 p refs
(AD-769929; GAW/MC/73-8) Avail: NTIS CSCL 16/4

A geometric configuration design for a guided modular weapon with an 800-lb warhead and canard controls was developed, based on preliminary computation of aerodynamic data. The applicable stability derivatives for forty-five variations of canard and tail wing size were computed and the subsonic longitudinal stability and control characteristics were evaluated. The primary criteria considered in the evaluation were maneuver load factor capability and perturbed dynamic response, with constraints on static margin, control deflection, and trimmed angle of attack. The sensitivity to weight and center of gravity variations and the time response to control deflection inputs were also evaluated to arrive at a suitable configuration design. Maneuver load factor capability greater than 1.5 g's with a controls fixed static margin exceeding 1.5 calibers appears feasible for the preliminary design. The maneuver capability can be achieved with both maximum trimmed angle of attack and maximum control deflection less than 10 degrees. Author (GRA)

N74-17588# Tennessee Univ., Knoxville.
DETERMINATION OF AN OPTIMAL GUIDANCE CONTROL LAW FOR AN ANTI-BALLISTIC MISSILE Report for 27 Mar. - 30 Sep. 1973
J. M. Bailey and D. H. Pike 1 Oct. 1973 53 p refs
(Contract DAHC60-73-C-0050)
(AD-769923) Avail: NTIS CSCL 15/3

The report addresses the problem of developing a guidance law using a dynamic programming technique. In the body of the report the guidance law is developed, a set of three scenarios are simulated, and the histograms are presented. (Modified author abstract) GRA

N74-17589# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MAXIUM LAUNCH RANGE FOR AN AIR-TO-AIR MISSILE EMPLOYING PROPORTIONAL NAVIGATION FOR GUIDANCE M.S. Thesis
Timothy J. Graves Jun. 1973 65 p refs
(AD-770082; GAW/MC/73-6) Avail: NTIS CSCL 16/2

Optimal control theory is used to find the necessary conditions for maximizing the launch range of an air-to-air missile employing proportional navigation for guidance. Use of the first-order gradient technique provides an optimal solution for one- and two-dimensional intercept trajectories where thrust magnitude is

the only control. A near-optimal, empirical method is developed and used for comparison. Results indicate that the launch range of the class of missiles considered is nearly insensitive to the thrusting schedule employed, suggesting that the low gain in launch range over present constant thrust methods may not warrant the increased complexity of an optimal design. Further, the results of the easier empirical method agree closely enough with the optimal method to suggest use of the empirical method in lieu of the gradient technique. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-17590 Purdue Univ., Lafayette, Ind.
STRESS AND DEFORMATION OF ARBITRARY THIN ELASTIC SHELLS Ph.D. Thesis
Paul Norbert Roschke 1973 90 p
Avail: Univ. Microfilms Order No. 73-28136

The basic equations of linear elastic bending theory of arbitrary thin shells are formulated in general vector form. A finite difference numerical procedure is developed for determination of the desired deformations and stresses. The projection of suitable regular reference coordinate lines to the general shell determines the two-dimensional curvilinear, or Gaussian, coordinates for the general shell middle surface, thus eliminating the task of locating nodal positions as encountered in finite element methods. Determination of the principal direction curvilinear coordinates at each nodal point of the shell allows development of expressions relating the normal and shearing strains to the principal direction components of the displacement vector of the middle surface. Differential relationships between the reference surface coordinates and the principal direction curvilinear coordinates are established. Dissert. Abstr.

N74-17591 Purdue Univ., Lafayette, Ind.
A STUDY OF FREE VIBRATIONS OF THIN ELASTIC SHELLS SUBJECTED TO INITIAL LOADS USING FINITE ELEMENTS Ph.D. Thesis
Hang Wook Kim 1973 168 p
Avail: Univ. Microfilms Order No. 73-28096

To treat the vibration problems and stability problems of shell structures together, the governing equation is derived in matrix form by energy method for a high order shell finite element. The shell finite element is defined by specifying the geometry of the middle surface, displacement functions, and strain-displacement relations. The radii of curvature and Lame parameters are assumed to be constant within an element. To obtain the constant matrices in the governing equations, an integration technique is developed by utilizing the character of polynominals in integration. This efficient integration method easily accounts for the nonuniformly distributed initial stress, variable Lame parameters and radii of curvature. In addition to the problem above, a new conical shell finite element is developed to illustrate how the doubly-curved shell finite element may be modified for those shells whose radii of curvature and Lame parameters are not constant. Free vibration problems of conical shells with various opening angles are solved as numerical examples. Dissert. Abstr.

N74-17592 Stanford Univ., Calif.
OPTIMAL SIZING OF COMPLEX STRUCTURAL SYSTEMS FOR FLUTTER REQUIREMENTS Ph.D. Thesis
Lawrence Boyd Gwin 1973 110 p
Avail: Univ. Microfilms Order No. 73-30405

Aeroelastic optimization is concerned with the determination of the particular design of a structural system that will render the extreme value of some merit index, usually selected as a function expressing structural weight, such that performance requirements involving aeroelastic eigenvalues are met. Following preliminary investigations that utilized continuous structural representations and classical function space optimization methods, recent research interest in this area has been directed to the development and application of methods that can be applied to more realistic structural representations. This trend has motivated the introduction of discrete analysis methods and parameter optimization techniques that operate in vector space. The treatment of the aeroelastic optimization problem using discrete methods is discussed. Dissert. Abstr.

N74-17593 North Carolina State Univ., Raleigh.
THE MECHANICS OF BENDING OF A MULTILAYER CANTILEVERED BEAM WITH FRICTION BETWEEN THE LAYERS Ph.D. Thesis
Michael Grant Miller 1973 64 p
Avail: Univ. Microfilms Order No. 73-29561

A study is made of the bending mechanics of a multilayer cantilevered beam assuming that the interfacial friction can be described by a Coulomb friction model. The objective of the study is the development of a bending model which can be utilized in adhesion tests of composite materials. The equilibrium equations are developed for each layers and the conditions for compatibility between the layers are identified. This permits formulating a general solution for the n-layered beam in terms of n-1 linear equations involving n-1 unknowns. An iterative solution technique, utilizing the digital computer, generates the load-deflection curve. The load-deflection curve is shown to consist of three distinct regions: an initial linear region in which the beam behaves as a solid one; a transition region in which the stiffness of the beam decreases; and a final linear region in which the beam behaves as if there was no friction between the layers. Dissert. Abstr.

N74-17594 Georgia Inst. of Tech., Atlanta.
THE EFFECT OF END FIXITY ON THE STABILITY OF STRUCTURES Ph.D. Thesis
Takaya Iwamoto 1973 155 p
Avail: Univ. Microfilms Order No. 73-29019

A new method of boundary evaluation, which associated the behavior of a structure under a non-destabilizing force system with the behavior of the same structure in a destabilizing environment, was proposed. The initial study demonstrated that in a number of cases the technique had significance for columns. However, the view point was restricted. It was not clear from the initial work whether the results were fortuitous or whether they were a consequence of a general principle. The results of detailed evaluations clearly establish that the prior results are the outcome of a general relationship basic to the issue. Dissert. Abstr.

N74-17595 Engineering Sciences Data Unit, London (England).
STIFFNESS OF LOADED FLAT STRIPS UNDER SINUSOIDALLY DISTRIBUTED BENDING COUPLES AT THEIR EDGES (FOR USE IN LOCAL BUCKLING CALCULATIONS), (UNIAXIAL OR BIAXIAL LOADING. ISOTROPIC OR ORTHOTROPIC MATERIALS)
Jul. 1973 20 p Sponsored by Roy. Aeron. Soc.
(ESDU-73007) Copyright. Avail: Issuing Activity

Curves for determining the stiffness of long flat strips initially subjected to in-plane uniform longitudinal and transverse direct stresses are presented. The stiffness relate to sinusoidally distributed edge rotations and the corresponding edge couples. The three modes of deformation of flat strips for which data are provided are illustrated and described. In all cases the strips are taken to be infinitely long, with excepting the one free edge of mode 1, all edges simply-supported. The data are based upon thin plate theory and apply to thin strips of isotropic materials or to thin strips of orthotropic materials whose moment-curvature relationships are given by D. The matrix D relates to strips whose principal axes of orthotropy are aligned with their edges and whose neutral axes for bending in the principal directions are coplanar. Author

N74-17596 Engineering Sciences Data Unit, London (England).
BUCKLING OF FLAT RETANGULAR ORTHOTROPIC PLATES (COMPUTER PROGRAM)
Mar. 1973 32 p Sponsored by Roy. Aeron. Soc.
(ESDU-73003) Copyright.

A computer program used to calculate the buckling loads of flat rectangular orthotropic plates under combinations of uniform in-plane biaxial direct and shear loads is presented. The program deals with symmetrical combinations of clamped and simply-supported edge conditions and takes account of out-of-plane shear deformations. The program may be applied to any panel that has principal planes of bending parallel to its edges and a common neutral plane. The axes are taken to lie in this neutral plane parallel to the edges. Author

N74-17597 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF ITEM NO. 73007
Dec. 1973 2 p ref
(ESDU-02.01.28-Amend-A-B) Copyright. Avail: Issuing Activity

The cross section of a single stringer, or of a complete stiffened panel, may often be regarded as made up of a number of thin flat strips joined edge to edge; these strips are referred to as component flats. Where the actual junction between component flats is rounded (as in a stringer section) representation by two flats joined at a sharp corner slightly underestimates the resistance of the section to deformation. The stiffness of a component flat to translation in its own plane is ofter much greater than the stiffness to rotation about the edge lines. It is then reasonable to assume that no component flat is translated in its own plane during buckling of the cross section and therefore the edge lines at the junctions between flats remain fixed in space. Then all possible modes of deformation involving only distortion of the cross section consist of pivoting of the component flats about their edge lines, and the only stiffness involved is the stiffness to rotation about those edge lines. Author

N74-17598 Engineering Sciences Data Unit, London (England).
FLEXIBLE CIRCULAR FRAMES SUPPORTING A SHELL. THE EFFECT OF ADJACENT FRAMES AND THE LONGITUDINAL FLEXIBILITY OF THE SHELL
Feb. 1973 3 p refs
(ESDU-03.06.17-Amend-A) Copyright. Avail: Issuing Activity

A numerical method for determining the mechanical properties of flexible circular frames supporting a shell is presented. Emphasis is placed on the effect of adjacent frames and the longitudinal flexibility of the shell. A mathematical model of a typical calculation is provided as an example. The data are presented in the form of curves for various configurations. Author

N74-17599 Engineering Sciences Data Unit, London (England).
INITIAL BUCKLING OF FLAT PLATES UNDER COMPRESSION, BENDING AND SHEAR
Sep. 1973 3 p refs
(ESDU-02.04.05-Amend-A) Copyright. Avail: Issuing Activity

A diagram is presented to show the initial buckling of flat plates under conditions of compression, bending, and shear. The diagram gives the critical value of the forces at which the plate first buckles under compression and bending combined with a shear stress. In addition, the diagram gives the critical value of the ratio of forces at which the plate buckles when already subjected to edge stresses. The plate is assumed to be isotropic, with Poission's ratio 0.3, and simply supported, but free from lateral restraint, along all four edges. Author

N74-17600 Engineering Sciences Data Unit, London (England).
AVERAGE AND EDGE STRESSES FOR FLAT PLATES UNDER SHEAR AND COMPRESSION
Sep. 1973 2 p refs Sponsored by Roy. Aeron. Soc.
(ESDU-02.04.02-Amend-A) Copyright. Avail: Issuing Activity

A numerical procedure for determining the average and edge stresses for flat plates under shear and compression loads is presented. The plate is compressed in the direction of its length, which is assumed to be three or more times its width. The edges are simply supported and remain straight. It is assumed that after buckling, the longitudinal edges are held a fixed distance apart. A mathematical model is included as a sample of the calculations involved. Author

N74-17601*# South Dakota State Univ., Brookings. Dept. of Mechanical Engineering.
PRIOR-TO-FAILURE EXTENSION OF FLAWS UNDER MONOTONIC AND PULSATING LOADINGS: INELASTIC FATIGUE Annual Progress Report
Michael P. Wnuk May 1971 40 p refs
(Grant NGR-42-003-006)
(NASA-CR-132399) Avail: NTIS HC $4.00 CSCL 20K

An equation governing the prior to failure crack propagation is proposed. For a rate-sensitive solid containing two-dimensional crack and subject to the tensile mode of fracture, the differential equations are integrated numerically for the loads increasing monotonically in time. The resulting integral curves sigma = sigma(l) and l = l(t), i.e. load vs. crack length and length vs. time, indicate that the growth of cracks in the subcritical range is strongly rate dependent. The fatigue growth, viewed as a sequence of slow growth periods, is simulated on an EAI 380 analogue computer. The fourth power law proposed by Paris is confirmed only within a certain range of high-cycle fatigue propagation and for a rate-insensitive solid. For a more pronounced rate dependency, induced by the viscosity of a solid and/or in the proximity of the final instability point, the growth is markedly enhanced. Author

N74-17602# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 5, NO. 5
May 1973 71 p refs
(AD-763025) Avail: NTIS MF $1.45; Shock and Vibration Center, Washington, D. C. 20390

The report contains articles and abstracts relative to shock and vibration phenomena in the following categories: analysis and design, environments, phenomenology, experimentation, components, and systems. GRA

N74-17603# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 5, NO. 6 SHOCK AND VIBRATION CENTER, WASHINGTON, D. C. 20390
Jun. 1973 73 p refs
(AD-762989) Avail: NTIS MF $1.45

The report contains articles and abstracts relative to shock and vibration phenomena in the following categories: analysis and design, environments, phenomenology, experimentation, components, and systems. GRA

N74-17604# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 5, NO. 7
Jul. 1973 57 p refs
(AD-765257) Avail: NTIS MF $1.45; Shock and Vibration Information Center, Code 8020, Naval Research Lab., Washington, D. C. 20375

The report contains abstracts relative to shock and vibration phenomena in the following categories; analysis and design, environments, phenomenology, experimentation, components, and systems. GRA

N74-17605# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 5, NO. 8
Aug. 1973 71 p refs
(AD-765258) Avail: NTIS MF $1.45; Shock and Vibration Information Center, Code 8020, Naval Research Lab., Washington, D. C. 20375

The report contains articles and abstracts relative to shock and vibration phenomena in the following categories: analysis and design, environments, phenomenology, experimentation, components, and systems. Author

N74-17606# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 5, NO. 9
Sep. 1973 53 p refs
(AD-767567) Avail: NTIS MF $1.45; Shock and Vibration Information Center, Code 8020, Naval Research Lab., Washington, D. C. 20375

For abstract, see N74-17605.

N74-17607# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 5, NO. 10
Oct. 1973 69 p refs
(AD-768306) Avail: NTIS MF $1.45 Shock and Vibration Center, Washington, D. C. 20390
For abstract, see N74-17602.

N74-17608# Shock and Vibration Information Center (Defense), Washington, D.C.
SHOCK AND VIBRATION DIGEST, VOLUME 5, NO. 11
Nov. 1973 90 p refs
(AD-769644) Avail: NTIS MF $1.45; Shock and Vibration Center, Washington, D. C. 20390
Contents: Analysis and design of exhaust mufflers--recent developments; Reviews of meetings; Advance program of the 44th shock and vibration symposium; News briefs; Short courses; Document information; Abstracts from the current literature.
GRA

N74-17609# Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 5, NO. 12
Dec. 1973 141 p refs
(AD-773330) Avail: NTIS MF $1.45; Shock and Vibration Center, Washington, D. C. 20390
For abstract, see N74-17602.

N74-17610*# Wisconsin Univ., Milwaukee.
SENSITIVITY ANALYSIS OF TORSIONAL VIBRATION CHARACTERISTICS OF HELICOPTER ROTOR BLADES. PART 1: STRUCTURAL DYNAMICS ANALYSIS
Theodore Bratanow and Akin Ecer Washington NASA Mar. 1974 48 p refs
(Grant NGR-50-007-001)
(NASA-CR-2379) Avail: NTIS HC $3.25 CSCL 01/3
A theoretical investigation of structural vibration characteristics of rotor blades was carried out. Coupled equations of motion for flapwise bending and torsion were formulated for rotor blades with noncollinear elastic and mass axes. The finite element method was applied for a detailed representation of blade structural properties. Coupled structural mass and stiffness coefficients were evaluated. The range of validity of a set of coupled equations of motion linearized with respect to eccentricity between elastic and mass axes was investigated. The sensitivity of blade vibration characteristics to torsion were evaluated by varying blade geometric properties, boundary conditions, and eccentricities between mass and elastic axes. Author

N74-17611*# Wisconsin Univ., Milwaukee.
SENSITIVITY ANALYSIS OF TORSIONAL VIBRATION CHARACTERISTICS OF HELICOPTER ROTOR BLADES. PART 2: AERODYNAMICS AND SENSITIVITY ANALYSIS
Theodore Bratanow and Akin Ecer Washington NASA Mar. 1974 64 p refs
(Grant NGR-50-007-001)
(NASA-CR-2380) Avail: NTIS HC $3.75 CSCL 01/3
A theoretical investigation of dynamic response characteristics of rotor blades was carried out with special emphasis on torsional degrees-of-freedom. Coupled equations of motion for flapwise bending and torsion were formulated at varying azimuth positions for rotor blades with noncollinear aerodynamic, elastic and mass axes. Both structural and aerodynamic mass, damping and stiffness coefficients were included. The variations of a sample blade at different flight conditions were investigated from these equations. The obtained numerical results were illustrated. The sensitivity of overall blade vibration characteristics to torsional oscillations was also investigated from the equations of motion for the sample blade. The illustrated results show the importance of torsional degrees-of-freedom in rotor blade analysis. Various possibilities of improving the overall response by tuning blade geometric, structural and aerodynamic characteristics are discussed. Author

N74-17612# Danish Research Center for Applied Electronics, Hoersholm.
MECHANICAL JOINT METHOD: STUDIES OF RESISTANCE TIGHTENING BY VIBRATION, INCLUDES 13 VARIATIONS OF bl.a.3 mm RIVET- AND SCREW CONNECTIONS [MEKANISKE SAMLEMETODER: UNDERSOEGELSE AF MODSTANDSDYGTIGHED MOD VIBRATION. OMFATTER 13 VARIANTER AF bl.a.3 mm NITTE-OG LASEDE SKRUEFORBINDELSER]
B. E. Bang Oct. 1973 51 p In DANISH; ENGLISH summary
(ECR-36) Avail: NTIS HC $5.75
The characteristics of joints in a vibration environment under conditions, which to a certain degree simulate stresses occuring in practice are investigated. For the dynamical exposure of the joints an experimental model is used, in which the simulation of the stresses mentioned takes place when submitted to vibration. Within the limits of the project types of joints are selected, which apparently are used in most industries to-day. Author

N74-17613# Technion - Israel Inst. of Tech., Haifa. Dept. of Mechanics.
THERMOELASTIC STABILITY OF LAMINATED ORTHOTROPIC CIRCULAR PLATES
Yehuda Stavsky Dec. 1973 43 p refs
(TDM-73-33) Avail: NTIS HC $5.25
Axisymmetric stability and thermal-buckling equations are established for circular plates composed of polar-orthotropic layers subjected to mechanical loads depending only on r and thermal fields T = T(r,z). Alternative fourth order systems of two coupled differential equations are suggested in terms of the slope beta and either the radial displacements u or a stress function psi. The eigenvalue problem is formulated for quasi-heterogeneous composite plates and a closed-type solution is given for certain thermal-buckling problems in the form of Bessel functions of first kind and fractional order. Possibility of an analogy between a thermal and mechanical stability problem is shown and variation of eigenvalues with anisotropy parameters is noted. Numerous examples are presented indicating that suitable lamination of composite circular plates may transcend the buckling loads of individual constituents. Author

N74-17614*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
STRESS INTENSITY FACTORS FOR DEEP CRACKS EMANATING FROM THE CORNER FORMED BY A HOLE INTERSECTING A PLATE SURFACE Technical Report, Fall 1972 - Fall 1973
J. J. McGowan and C. W. Smith Jan. 1974 28 p refs
(Grant NGR-47-004-476)
(NASA-CR-136930; VPI-E-74-1) Avail: NTIS HC $4.50 CSCL 20K
A technique consisting of a marriage between stress freezing photoelasticity and a numerical method was used to obtain stress intensity factors for natural cracks emanating from the corner at which a hole intersects a plate surface. Geometrics studied were: crack depth to thickness ratios of approximately 0.2, 0.5, and 0.75; crack depth to crack length ratios of approximately 1.0 to 2.0. All final crack geometries were grown under monotonic loading and growth was not self similar with most of the growth occurring through the thickness under remote extension. Stress intensity plate surface K sub s factors were determined at the intersection of the flaw border with the plate surface K sub s and with the edge of the hole K sub h. Results showed that for the relatively shallow flaws K sub h approximately equal to 1.5 K sub s, for the moderately deep flaws K sub h approximately equal to K sub s, and for the deep flaws K sub h approximately equal to 0.5 K sub s, revealing a severe sensitivity of K to flaw geometry. Author

N74-17615# Space Science and Technology Centre, Trivandrum (India). Structural Engineering Div.
RESPONSE OF STRUCTURES TO RANDOM ACOUSTIC EXCITATION: AN EXPERIMENTAL STUDY
B. Rama Bhat, B. V. A. Rao (Indian Inst. of Tech., Madras), and Hans Wagner (Staatliche Ingenieurschule, Karlsruhe, West Germany) 6 Nov. 1973 34 p refs Backup document for AIAA Synoptic scheduled for publication in the Journal of Spacecraft and Rockets in Apr. 1974.

Avail: NTIS HC $4.75

The response of structures to a peaked type of power spectral density of loading which represented the actual random excitations realistically is discussed. Response accelerations were measured for structures such as flat and stiffened plates. The structures were analyzed for their power spectral density and autocorrelation functions. The random loading is uniform over the plate area so that the space correlation may be assumed unity. Mathematical models are included to support the theoretical considerations.
Author

N74-17616# Ernst-Mach-Inst., Freiburg (West Germany).
LOAD TRANSMITTED TO FRAME BUILDINGS DURING BLOWOUT OF SURFACE PANELS BY NUCLEAR BLAST
George Sliter Oct. 1972 105 p refs Sponsored by Bundesmin. fuer Wohnungswesen und Staedtebau
(Rept-1/73) Avail: NTIS HC $8.25

The loads transmitted to a frame building during blowout of light surface asbestos cement panels by nuclear blast were investigated. Up to the time of panel fracture, the measured force agreed reasonably well with the force predicted by a small deflection elastic eigenfrequency analysis. After fracture the impulse delivered to the frame continued to increase substantially. An estimate of blowout impulse on critical damage based on theory and measurements was applied to a single degree of freedom model of typical buildings. It was shown that the effect decreases with increasing building parameter. For the panels, support conditions, and building parameters considered, the effect of blowout impulse was found to be small. ESRO

N74-17617# Danish Atomic Energy Commission, Risoe. Metallurgy Dept.
IRRADIATION EMBRITTLEMENT OF PRESSURE VESSEL STEELS
A. Nielsen and J. Westermann Jul. 1973 27 p Sponsored by IAEA
(RISO-M-1634) Avail: AEC Depository Libraries HC $3.50

Several institutes in different countries agreed to irradiation experiments according to the approved program on steel A 533B from the American HSST program. Danish research on tensile, impact, and hardness properties of nonirradiated steel and steel irradiated at 290 C to 2 x 10 to the 19th power (n sub f)/sq cm is summarized. Author (NSA)

N74-17618# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
FRACTURE BEHAVIOUR OF UNIRRADIATED AND IRRADIATED STEELS: A BIBLIOGRAPHY, 1951 - 1972
P. J. Geue, comp. Oct. 1972 112 p refs
(AAEC/LIB/BIB-370) Avail: AEC Depository Libraries HC $7.75

Four hundred forty-nine references are listed chronologically covering the period 1951-1972; references are limited to those of the Naval Research Labs., Washington, D.C. and associated authors. Reference is made to abstracts in different abstracting services where relevant. Author (NSA)

N74-17619# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
APPLICATION OF VIBRATORY METHODS TO THE DETERMINATION OF THE ELASTIC CHARACTERISTICS OF ISOTROPIC MATERIALS OR MATERIALS HAVING A RECTANGULAR HETEROTROPY
L. Bourgain, G. Samson, and D. Boulegue 1 Feb. 1973 27 p refs In FRENCH Presented at Meeting on the Propagation of Vibrations, Grenoble, 1-2 Feb. 1973
(CEA-CONF-2276; Conf-730218-1) Avail: AEC Depository Libraries HC $3.50

Several nondestructive virbration methods for investigating the elastic properties of rectangular materials are discussed. Data cover composite materials, transverse displacement, and mechanical properties. An analysis was made of the accuracy of the values obtained and possible applications. Mathematical models are included. Transl. by E.H.W.

N74-17620# Scientific Translation Service, Ann Arbor, Mich.
CYCLIC CREEP RUPTURE IN LOW-CYCLE FATIGUE
E. Shiratori 1972 12 p refs Transl. into ENGLISH from Zairyo (Kyoto), v. 21, no. 227, 1972 p 720-724 Prepared for ORNL Sponsored by AEC
(ORNL-TR-2713) Avail: NTIS HC $3.00

When load-controlled low-cycle fatigue tests at a mean stress increment are conducted, there are instances in which the specimens undergo deformation with repeated cycles, eventually becoming unstable and rupturing. Similar phenomena are observed with deformation in the direction of tensile stress when a cyclic torsional stress is superimposed over a constant tensile stress and in torsional deformation that occurs when a cyclic compressive tensile stress is superimposed over a constant torsional stress. This phenomenon of progressive deformation that accompanies repeated load applications is called cyclic creep, and the resulting unstable rupture is called cyclic creep rupture. Research in this area is discussed, placing emphasis on dynamic stress analysis (numerical). Author (NSA)

N74-17621# Scientific Translation Service, Ann Arbor, Mich.
FEW PROBLEMS IN ESTIMATING FATIGUE
H. Nakamura, T. Kamata, and J. Horikawa 1972 18 p refs Transl. into ENGLISH from Zairyo, v. 21, 1972 p 725-732 Sponsored by AEC Prepared by ONRL
(ORNL-TR-2712) Avail: NTIS

Estimating the service life (fatigue strength) of various machinery and construction equipment has assumed great importance and is fast becoming a vital subject. It has been the practive to determine the S-N diagram or the sigma = n curves (stress-frequency /number of cycles/ curves) after which the Miner rule (sigma(n/N) = 1) is applied to calculate the strength; but many areas of uncertainty need clarification. Experiences in fatigue estimation are described along with explanations. Author (NSA)

N74-17622# Spar Aerospace Products, Ltd., Toronto (Ontario).
THE CONTINUUM MECHANICS DYNAMIC STUDY OF A SATELLITE WITH FLEXIBLE SOLAR PANELS Final Report
D. B. Cherchas and R. Kumar Jul. 1973 174 p
(Contract ESTEC-1723/72)
(SPAR-R-554; ESTEC-CR(P)-294) Avail: NTIS HC $11.75

A continuum mechanics dynamics analysis was performed to determine the natural modes of vibration of a communications satellite with large flexible solar arrays. Assuming a symmetric satellite model, all translational and rotational modes of vibration were studied and the first three modes of each type were calculated to give natural frequencies and mode shapes. The effects of array boom root flexibility, array boom torsional stiffness, array solar cell blanket stiffness and body mass on the natural modes were established. The rotational natural modes were utilized to determine the response of the spacecraft to attitude control system inputs: (1) constant pitch, (2) roll and (3) yaw torques of short duration. The spacecraft response was found by superposing the rigid spacecraft motions with the 'flexible' spacecraft motions described by the natural modes. The array boom tip motions, body angles and angular rates and torques experienced by the body due to flexible oscillations of the arrays were calculated. The response was found using one, two and three natural modes of the appropriate type to evaluate the effect of the higher frequency modes. Author (ESRO)

N74-17623# National Aerospace Lab., Amsterdam (Netherlands).
FATIGUE CRACK GROWTH IN ALUMINUM ALLOY SHEET MATERIAL UNDER FLIGHT-SIMULATION LOADING. EFFECTS OF DESIGN STRESS LEVEL AND LOADING FREQUENCY
J. Schijve, F. A. Jacobs, and P. J. Tromp [1973] 26 p refs Submitted for publication Sponsored by Neth. Agency for Aerospace Programs
(NLR-TR-72018-U) Avail: NTIS HC $4.50

Specimens of 2024-T3 and 7075-T6 aluminum alloys were tested at 10, 1, and 0.1 cps. Values of mean stress in flight were 10.0, 8.5, 7.0, 5.5, and 4.0 kg/sq mm. The analysis of the results focus upon the frequency effect and its significance for inspection periods in service, the effect of stress level, a comparison between the two alloys, the prediction of crack rates in flight simulation tests, and the meaning of the stress intensity factor for the latter purpose. ESRO

N74-17624# Boeing Vertol Co., Philadelphia, Pa.
THE EVALUATION OF ACOUSTIC IMPACT TECHNIQUE FOR DETECTION OF INCIPIENTS CRACKS IN AIRCRAFT COMPONENTS Final Report, 1 Jul. 1971 - 30 Jun. 1972
Russell H. Bickford, G. V. Demchak, and J. J. Sciarra Jul. 1973 114 p refs
(Contract F33615-71-C-1769)
(AD-770217; AFML-TR-73-146) Avail: NTIS CSCL 11/6

The need for a reliable method for detection of incipient cracks near or under fasteners in aircraft structures is well known. Previous work to develop an acoustic impact technique for crack detection has lead to this program. The objective of this program is to permit or preclude the use of this technique as a field inspection tool. This investigation is directed toward evaluating the reliability and reproducibility of test data to determine those variables which effect validity of test data and performance. Investigations indicated that the acoustic impact technique system is not a feasible tool for the detection of incipient cracks in aircraft components. (Modified author abstract) GRA

N74-17625# Virginia Polytechnic Inst. and State Univ., Blacksburg.
A FINITE ELEMENT METHOD FOR THE DETERMINATION OF TWO-DIMENSIONAL RESIDUAL STRESS FIELDS
Ali Candogan and K. L. Reifsnider 27 Jul. 1973 34 p refs
(Contract DAAF07-69-C-0444)
(AD-770030; VPI-E-73-26) Avail: NTIS CSCL 11/6

A finite element model has been developed to analyze a single-edge-notched specimen subject to cyclic loading in the elastoplastically, unloaded, and the resulting residual stresses calculated by two independent methods. The specimens were then reloaded elastically along the unloading path. In the present analysis, residual stress values which were obtained near the crack tip exceeded the nominal remote loading stress by 50%. Through the use of the finite element method, a numerical boundary value solution method is developed for the residual stress problem. The investigators believe that this is the first such analytical solution of the two-dimensional residual stress problem at a singularity. The general trends of the results obtained in this study are in close agreement with the experimental and theoretical fracture mechanics concepts. (Modified author abstract) GRA

N74-17626# RAND Corp., Santa Monica, Calif.
HIGH-PERFORMANCE COMPOSITE MATERIALS FOR VEHICLE CONSTRUCTION: AN ELASTOPLASTIC ANALYSIS OF CRACK PROPAGATION IN A UNIDIRECTIONAL COMPOSITE
Donald F. Adams Mar. 1973 105 p refs
(Contract F44620-73-C-0011; Proj. RAND)
(AD-769867; R-1070-PR) Avail: NTIS CSCL 11/4

A method was developed for predicting the strength of a unidirectional composite material in terms of its micromechanical response to an applied stress. It includes elastoplastic material behavior, local failure that initiates a crack, and propagation of the crack to cause total failure of the composite. GRA

N74-17627# Watervliet Arsenal, N.Y.
FLEXURE EQUATIONS OF MOTION FOR LAMINATED COMPOSITE BEAMS
Charles R. Thomas Oct. 1973 24 p refs
(DA Proj. 1F0-61102-A-35D)
(AD-770394; R-WV-T-6-45-73) Avail: NTIS CSCL 13/13

A flexural theory for laminated composite beams is obtained directly from a reduction of existing flexure equations for composite plates. Results previously developed for plate strips are shown to be directly applicable to beam problems if slight changes are made in the elastic constants. (Modified author abstract) GRA

N74-17628# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN INVESTIGATION OF THE BENDING OF SYMMETRIC PLATES UNDER SYMMETRIC TRANSVERSE LOADING M.S. Thesis
Thomas A. Runner Dec. 1972 135 p refs
(AD-769928; GAM/MC/73-4) Avail: NTIS CSCL 01/3

An investigation is conducted on transversely loaded clamped plates using the displacement method computer program 'Matrix Analysis via Generative and Interpretive Computations' (MAGIC). Three plate configurations are examined. These are a rectangular plate without cutouts, a rectangular plate with cutouts, and a circular plate with a central circular hole. Each plate configuration is modeled using a number of different structural idealizations. Three bending elements from the MAGIC element library are used for the investigation. The elements used are the quadrilateral thin shell, the triangular thin shell, and the quadrilateral plate element. (Modified author abstract) GRA

N74-17629# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EIGENVALUE ANALYSIS OF LARGE, COMPLEX STRUCTURES BY THE STATIC CONDENSATION TECHNIQUE
Stephen S. Britten 19 Sep. 1973 28 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-769856; ESD-TR-73-245) Avail: NTIS CSCL 13/13

The static condensation technique, as applied to the eigenvalue analysis of large complex structures, is evaluated using ICES/STRUDL. Accuracy is verified by two simple test problems. A real-life problem of considerable magnitude delineates the technique's merits as problem size varies. Back transformation of results to condensed degrees of freedom is shown to be expensive if not really needed (i.e., if member forces are not required). Also shown essential for large, complex structures are: good banding algorithm, exhibiting reductions in solution time, lumped-mass approach to provide comparable accuracy at less cost over the consistent-mass approach, and graphics package to process input data and present output graphically.
Author (GRA)

N74-17630# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE THEORY OF RODS. PART 1: DERIVATIONS FROM THE THREE DIMENSIONAL EQUATIONS
A. E. Green (Oxford Univ.), P. M. Naghdi, and M. L. Wenner (General Motors Corp.) Oct. 1973 71 p refs
(Contract N00014-69-A-0200-1008)
(AD-770047; AM-73-4-Pt-1) Avail: NTIS CSCL 20/11

Starting with the three-dimensional theory of classical continuum mechanics, some aspects of both the nonlinear and the linear theories of elastic rods are discussed. Detailed attention is given to the derivation of constitutive equations for the linear isothermal theory of elastic rods of an isotropic material and of variable cross-section, deduced by an approximation procedure from the three-dimensional equations. Explicit linear constitutive relations are obtained for straight circular rods of non-uniform cross-section; the calculation is carried out (in terms of an approximate specific Gibbs free energy function) in four distinct parts, since the complete system of equations involved separate into those appropriate for extensional, torsional and two flexural modes of deformation. A system of displacement differential equations are derived for flexure of a beam of variable circular cross-section; they reduce to those of the Timoshenko beam theory when the radius of the cross-section is constant.
Author (GRA)

N74-17631# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON THE THEORY OF RODS. PART 2: DEVELOPMENTS BY DIRECT APPROACH
A. E. Green (Oxford Univ.), P. M. Naghdi, and M. L. Wenner (General Motors Corp.) Nov. 1973 58 p refs
(Contract N00014-69-A-0200-1008)
(AD-770048; AM-73-5-Pt-2) Avail: NTIS CSCL 20/11

The paper, which may be regarded as a companion to part 1 under the same title, is concerned with some aspects of both the nonlinear and the linear theories of elastic rods by a direct approach based on the theory of a Cosserat curve with two directors. Special attention is given to the development of the linear isothermal theory of straight isotropic rods of variable cross-section possessing two axes of symmetry. The resulting system of equations, which are applicable to rods of non-uniform section, separate into those appropriate for extensional, torsional and flexural modes of deformation. Application of these results to torsion and flexure of non-uniform rods are considered, and the problem of identification of constitutive coefficients for rods of uniform cross-section is dealt with at some length.
Author (GRA)

N74-17632# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF ELASTOMERIC VIBRATION ISOLATORS M.S. Thesis
Michael F. Tedesco Jun. 1973 73 p refs
(AD-770279; GA/MC/73-6) Avail: NTIS CSCL 13/9

The study was conducted to develop a simple mathematical model of the T22-AB-2 elastomeric vibration isolator. The isolators were tested both statically and dynamically to determine their response characteristics. It was found that the static stiffness as determined from force-deflection curves is significantly less than the stiffness determined from vibration testing. The dynamic modulus and loss factor were determined to be nonlinear functions of isolator displacement. Two mathematical models were developed. A linear model is adequate in predicting resonant frequencies and resonant peaks for double amplitude deflections of .1 inch or less. A nonlinear model following Duffing's method shows a small amount of the nonlinearity of the isolators. It was determined that it is not possible to develop a simple mathematical model of elastomeric vibration isolators based on their static characteristics. Author (GRA)

N74-17633# Teledyne Materials Research Co., Waltham, Mass.
A METHOD FOR DIGITIZING, PREPARING AND USING LIBRARY TAPES OF SHIP STRESS AND ENVIRONMENT DATA, PART 1 Final Technical Report
Aldie E. Johnson, Jr., James A. Flaherty, and Isaac J. Walters Feb. 1973 66 p refs
(Contract N00024-69-C-5161; SR Proj. 187)
(AD-767388; E-1149(C)-Pt-1; SSC-236) Avail: NTIS CSCL 13/10

Midship bending stress and environmental data from four dry-cargo ships, accumulated during the period 1959 through early 1970 under Ship Structure Committee Project SR-153, Ship Response Statistics, have been processed and written on digital magnetic tapes. During the processing, selected statistical information was derived which has been included on the digital tapes for each of the 13220 intervals recorded. The original FM analog data were contained on 163 reels of magnetic tape. The entire collection is now stored on 25 reels of digital tape and tape and pertinent reduced data from each interval are stored on two summary reels. Processor programs were written to convert the original analog data and environmental information to the final digital format and to provide a capability to extract portions of the data for subsequent statistical analysis. Author (GRA)

N74-17634# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
PLASTIC BUCKLING
John W. Hutchinson Jul. 1973 121 p refs
(Grant AF-AFOSR-2476-72; AF Proj. 9782)
(AFOSR-73-2083TR; AD-770649; DEAP-S-3) Avail: NTIS CSCL 20/11

A survey of plastic buckling is given. Emphasis is placed on post-buckling behavior and imperfection-sensitivity in the plastic range, although the extent to which bifurcation load predictions depend on the choice of plasticity theory is reviewed at some length. Behavior of discrete and continuous structures is introduced by way of several simple models and a general treatment is presented for the most commonly used theory of plates and shells. A number of examples are discussed. Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-17635 State Univ. of New York, Buffalo.
COMBINED HEAT CONDUCTION AND RADIATION IN AN IRREGULAR DOMAIN WITH GENERAL BOUNDARY CONDITIONS THROUGH THE APPLICATION OF POTENTIAL THEORY Ph.D. Thesis
Richard Scott Smith, Jr. 1973 198 p
Avail: Univ. Microfilms Order No. 73-29138

The steady heat transfer in a conducting, emitting and absorbing medium bounded by a general closed curve is analyzed. The potential theory is developed for the Laplace equation with Dirichlet, Neumann and convective boundary conditions in an interior, singly connected domain. Using Eddington's first approximation for radiative transfer, the problem is formulated in two differential equations, one for heat flux potential and the other for temperature. Using potential theory, these are then transformed into two coupled integral equations of the second kind which are then solved by the method of successive approximations. The heat flux potential provides insight into the total heat transfer in the medium and the effects of radiation on the heat transfer are clearly seen through a function, u, which is one component of the temperature. A one-dimensional transient heat conduction problem is solved using this approach and compared to results using standard techniques to show the validity of this method. Dissert. Abstr.

N74-17636 Post Office Research Dept., London (England).
THERMAL STABILITY OF RESIN COMPOUNDS FOR SEMICONDUCTOR DEVICE ENCAPSULATION
B. H. Conen and J. E. Eleftheriou 7 Jul. 1972 36 p refs
(Rept-300) Copyright. Avail: NTIS Avail: Issuing Activity

Since the testing of plastics encapsulated devices by current reliability assessment methods requires resin compounds to withstand temperatures as high as possible without introducing new failure mechanisms, tests for thermal stability were made on a wide range of epoxy and silicone moulding compounds. Measurements using scanning techniques provided only limited information in the temperature range below 300 C: isothermal weight loss measurements are more meaningful with respect to device testing and give data from which a ready comparison of thermal stabilities can be made. It is shown that ageing increases the moisture absorption of epoxy resin compounds, and a new approach to reliability testing, not involving temperature stressing, is suggested in order to preserve the original properties of the plastics encapsulants. Author

N74-17637# National Bureau of Standards, Boulder, Colo: Cryogenics Div.
THERMOPHYSICAL PROPERTIES OF NITROGEN FROM THE FUSION LINE TO 3500 R (1944K) FOR PRESSURES TO 150,000 PSIA (10342 x 10 TO THE FIFTH POWER N/m SQUARED)
R. T. Jacobsen (Idaho Univ.), R. B. Stewart (Idaho Univ.), R. D. McCarty, and H. J. M. Hanley Dec. 1973 163 p refs
(NBS-TN-648) Avail: SOD HC $1.25 as C13.46:648

Tables of thermophysical properties of nitrogen are presented for temperatures from the fusion line to 3500 R for pressures to 3000 psia, and from the fusion line to 1500 R for pressures above 3000 psia to 150,000 psia. The tables include values of entropy, enthalpy, internal energy, density, specific volume, velocity of sound, specific heats, thermal conductivity, viscosity, thermal diffusivity, Prandtl number, and the dielectric constant for selected isobars. Tables of selected isobars for the liquid and vapor phases, and for the saturated vapor and saturated liquid are included. An equation of state is presented for liquid and gaseous nitrogen for the temperature and pressure ranges of these tables. In the determination of the equation of state, all of the pressure-density-temperature data available from the published literature were reviewed, and appropriate corrections made to bring experimental temperatures into accord with the International Practical Temperature Scale of 1968. Author

N74-17638*# Martin Marietta Corp., Denver, Colo.
STUDY OF CRITICAL DEFECTS IN ABLATIVE HEAT SHIELD SYSTEMS FOR THE SPACE SHUTTLE Final Report
C. C. Miller and W. D. Rummel Washington NASA Feb. 1974 210 p refs
(Contract NAS1-10289)
(NASA-CR-2336; MCR-73-184) Avail: NTIS HC $5.75 CSCL 22B

Experimental results are presented for a program conducted to determine the effects of fabrication-induced defects on the performance of an ablative heat shield material. Exposures

representing a variety of space shuttle orbiter mission environments-humidity acoustics, hot vacuum and cold vacuum-culuminating in entry heating and transonic acoustics, were simulated on large panels containing intentional defects. Nondestructive methods for detecting the defects, were investigated. The baseline materials were two honeycomb-reinforced low density, silicone ablators, MG-36 and SS-41. Principal manufacturing-induced defects displaying a critical potential included: off-curing of the ablator, extreme low density, undercut (or crushed) honeycomb reinforcements, and poor wet-coating of honeycomb. Author

N74-17639*# General Applied Science Labs., Inc., Westbury, N.Y.

ENGINEERING ANALYSES AND DESIGN CALCULATIONS OF NASA, LANGLEY RESEARCH CENTER HYDROGEN-AIR-VITIATED HEATER WITH OXYGEN REPLENISHMENT

[1973] 131 p refs

(Contract NAS1-8669)

(NASA-CR-132381; TM-173) Avail: NTIS HC $9.50 CSCL 20M

The technical basis is presented for the design of the hydrogen-air-vitiated heater. The heater liner is subjected to a maximum thermal environment at a specified condition, where the combustion gas temperature, pressure and flow rate are 5000 F, 750 psia, and 11.0 lb/sec, respectively, and results in a heat flux of the order of 275 BTU/sec-sq ft. Cooling and stress analyses indicate that water is the logical choice for cooling of the combustor liner. A mixing analysis was undertaken to establish a good combination of combustor length and injector configuration. The analysis, using a conservative analytical approach, indicates a combustor length of the order of 5 ft combined with discrete fuel and oxidizer injection at an approximate 2-1/2 inch radial combustor position, and results in uniform combustion products at the heater exit for all specified envelope conditions. Author

N74-17640*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

HEAT TRANSFER MODEL FOR PREDICTING SQUIB IGNITION TIMES

V. Sernas 15 Jan. 1974 32 p refs

(Contract NAS7-100)

(NASA-CR-136834; JPL-TM-33-655) Avail: NTIS HC $4.75 CSCL 20M

A squib ignition model based on transient heat condition from the hot bridgewire to the pyrotechnic is described. No Arrhenius-type chemical reaction is included. Instead, a thermal contact resistance is postulated to exist between the hot bridgewire and the pyrotechnic. Ignition is assumed to occur when a 2.5 micron layer of pyrotechnic next to the bridgewire reaches a characteristic ignition temperature for that pyrotechnic. This model was applied to the JPL squib, which uses a 50 micron (0.002-in.) diameter Tophet A bridgewire to ignite a boron, potassium perchlorate mix. A computer program was utilized that solves the transient heat condition problem with the boundary conditions stipulated by the model. The thermal contact conductance at the interface was determined by trial and error so that the experimentally determined ignition time for one firing condition would be properly predicted by the model. The agreement was quite good for tests run between -129 C and +93.3 C at current levels of 3.5 and 5 A. Axial heat conduction along the bridgewire is shown to be negligible. Author

N74-17641*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A HOMOGENEOUS HEAT PIPE DESIGN CODE

A. M. Nakashima and G. M. Kikin 15 Jan. 1974 34 p refs

(Contract NAS7-100)

(NASA-CR-136831; JPL-TM-33-663) Avail: NTIS HC $4.75 CSCL 20M

A computer program was developed to facilitate parametric performance evaluation of heat pipes in lightweight heat rejection systems. A description of the code, user's manual, and sample inputs are provided. The emphasis is placed on the analysis and design of homogeneous wick heat pipes. The analysis of the annular heat pipe is included as part of the heat pipe radiator subroutine. Author

N74-17642*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EMISSIONS OF NITROGEN OXIDES FROM AN EXPERIMENTAL HYDROGEN-FUELED GAS TURBINE COMBUSTOR

Carl T. Norgren and Robert D. Ingebo Washington Feb. 1974 22 p refs

(NASA-TM-X-2997; E-7745) Avail: NTIS HC $3.00 CSCL 21E

The effect of operating variables of a hydrogen fueled combustor on exhaust concentrations of total oxides of nitrogen was determined at inlet-air temperature levels up to 810 K, pressure of 414,000N/sa m, and reference velocity of 21.3 m/sec. The combustor, which was originally designed for hydrocarbon fuel produced a NO(x) concentration of 380 ppm with hydrogen at 810 K inlet-air temperature. A reduction in NO(x) of about 30 % was obtained by modification to a lean or rich primary zone. The lowest NO(x) levels obtained with hydrogen were equivalent to those of the reference combustor burning hydrocarbon fuels. Author

N74-17643*# TRW Systems Group, Redondo Beach, Calif.

VARIABLE CONDUCTANCE HEAT PIPE TECHNOLOGY

B. D. Marcus, D. K. Edwards, and W. T. Anderson Dec. 1973 140 p refs

(Contract NAS2-5503)

(NASA-CR-114686; RR-4) Avail: NTIS HC $10.00 CSCL 20M

Research and development programs in variable conductance heat pipe technology were conducted. The treatment has been comprehensive, involving theoretical and/or experimental studies in hydrostatics, hydrodynamics, heat transfer into and out of the pipe, fluid selection, and materials compatibility, in addition to the principal subject of variable conductance control techniques. Efforts were not limited to analytical work and laboratory experimentation, but extended to the development, fabrication and test of spacecraft hardware, culminating in the successful flight of the Ames Heat Pipe Experiment on the OAO-C spacecraft. Author

N74-17644*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

AN EFFICIENCY STUDY ON OBTAINING THE MINIMUM WEIGHT OF A THERMAL PROTECTION SYSTEM

S. D. Williams (Lockheed Electron. Co., Inc., Houston, Tex.) and D. M. Curry Jan. 1974 12 p refs

(NASA-TM-X-58126; JSC-08678) Avail: NTIS HC $4.00 CSCL 20/13

Three minimizing techniques are evaluated to determine the most efficient method for minimizing the weight of a thermal protection system and for reducing computer usage time. The methods used (numerical optimization and nonlinear least squares) for solving the minimum-weight problem involving more than one material and more than one constraint are discussed. In addition, the one material and one constraint problem is discussed. Author

N74-17645*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

EFFECTS OF SELECTED TRAJECTORY PARAMETERS ON WEIGHT TRENDS IN THE SHUTTLE THERMAL PROTECTION SYSTEM

Donald M. Curry, James W. Tolin, Jr., and Winston D. Goodrich Jan. 1974 39 p refs

(NASA-TM-X-58113; JSC-08585) Avail: NTIS HC $5.00 CSCL 20M

An empirical heating model, thermal protection system unit weight correlation, and trajectory analysis were used to develop a computation procedure for studying the sensitivity of thermal protection system weights to variations in pertinent trajectory parameters. The analytical techniques used in developing this computer program are described. Application of the analysis to a Space Shuttle Orbiter configuration was performed to demonstrate gross thermal protection system weight trends with selected entry trajectory parameters. Author

N74-17646*# Rocketdyne, Canoga Park, Calif.

ANALYTICAL AND EXPERIMENTAL STUDY OF RESO-

NANCE IGNITION TUBES Final Report
Leon Stabinsky 12 Dec. 1973 87 p refs Prepared for JPL (Contracts NAS7-100; JPL-953563)
(NASA-CR-136934; R-9403) Avail: NTIS HC $7.50 CSCL 21B

The application of the gas-dynamic resonance concept was investigated in relation to ignition of rocket propulsion systems. Analytical studies were conducted to delineate the potential uses of resonance ignition in oxygen/hydrogen bipropellant and hydrazine monopropellant rocket engines. Experimental studies were made to: (1) optimize the resonance igniter configuration, and (2) evaluate the ignition characteristics when operating with low temperature oxygen and hydrogen at the inlet to the igniter. Author

N74-17647# United Kingdom Atomic Energy Authority, Culham (England).
THERMAL CONVECTION DRIVEN BY INTERNAL HEAT SOURCES: AN ANNOTATED BIBLIOGRAPHY
R. S. Peckover and I. H. Hutchinson 16 Mar. 1973 30 p refs
(CLM-R-123) Avail: AEC Depository Libraries HC $3.50; HMSO 50p; PHI $2.15

A bibliography of 43 papers on thermal convection driven at least partially by internal heat sources is presented. The commentary is partly an indication of the contents of each paper, and is partly an expression of personal opinion. The papers are divided into the following sections: classical works on convection; Rumford convection in horizontal layers; Rumford convection in spheres and spherical shells; Rumford convection in vertical tubes; applications in geophysics and meteorology; and turbulent convection. Author (NSA)

N74-17648# Ohio State Univ. Research Foundation, Columbus.
SUPERSONIC COMBUSTION AND BURNING IN RAMJET COMBUSTORS Final Report, 1 Apr. 1972 - 31 Mar. 1973
Rudolph Edse, E. E. Rice, and C. T. Kitzmiller Jul. 1973 199 p refs
(Grant AF-AFOSR-1902-70; AF Proj. 9711)
(AD-770061; AFOSR-73-2025TR; SR-3) Avail: NTIS CSCL 21/2

The report contains research results obtained from experimental and theoretical studies of subsonic and supersonic burning in ramjet combustors during the period 1 April 1972 to 31 March 1973. Hydrogen-oxygen mixtures sensitized by chlorine have been ignited photochemically at flow speeds from 350-550 m/s and photochemical ignition limits have been measured at pressures between 100 and 400 mmHg. The formation of weak detonation has been observed. Calculated ignition delay times have been found to agree satisfactorily with experimental values. Tables and graphs have been prepared for quick predictions of the changes resulting from heat addition to an existing sub- or supersonic flow, such as those in ramjet combustors. (Modified author abstract) GRA

N74-17649# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE COMBUSTION OF CONDENSED EXPLOSIVES (VV) IN THE CASE OF OVERLOADS
S. K. Ozdzhonikidze, A. D. Margolin, and P. F. Pokhil 7 Nov. 1973 10 p refs Transl. into ENGLISH of the mono. "Gorenie i Vzryv" USSR, 1972 p 83-86
(AD-769996; FTD-HT-23-630-74) Avail: NTIS CSCL 21/2

This work deals with the investigation of the combustion of solid, liquid, and water-filled systems in a field of inertial forces. The tests were conducted on a centrifuge with a radius of 4.5 cm at accelerations up to 2000 g. The samples were burned in a closed space at pressures up to 150 atm(tech.). The time of burning was determined by a pressure oscillogram. The solid composition investigated contained 15% rubber, 15% aluminum (particle dimensions up to 10 micrometers, and 70% ammonium perchlorate. The samples had a cross section area of 0.4 sq cm and a length from 0.5 to 1.5 cm. GRA

N74-17650# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS OFTEN ENCOUNTERED IN THE UNSTEADY COMBUSTION THEORY
Yu. I. Babenko 30 Oct. 1973 13 p refs Transl. into ENGLISH from the publ. "Gorenie i Vzrv" (USSR), 1972 p 115-119
(AD-770477; FTD-HT-23-638-74) Avail: NTIS CSCL 07/4

During the description of the unsteady processes in the theory of combustion, one often encounters the equation that describes heat transfer with the presence of unsteady convection. The report discusses methods of using this equation to find the temperature gradient at the boundary of a domain with respect to assigned change in boundary temperature and rate. GRA

N74-17651# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THERMAL EXPLOSION OF A HETEROGENEOUS SYSTEM OF TWO SEMI-BOUNDED BODIES
A. P. Babich, N. M. Belyaev, and A. A. Ryadno 6 Nov. 1973 12 p refs Transl. into ENGLISH from the publ. "Gorenie i Vzrv" USSR, 1972 p 49-52
(AD-770007; FTD-HT-23-622-74) Avail: NTIS CSCL 21/2

A one-dimensional nonstationary fuel system is examined which consists of two semi-bonded bodies. One is an oxidant, and the other is a fuel. Starting with the equations for the boundary value problems of thermal explosions, the expressions for the changes in temperature on the surface of a heterogeneous exothermic reaction are developed. F.O.S.

N74-17652# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IGNITION OF INITIATORS BY AN ELECTRICAL SPARK
A. I. Gavrilin and M. A. Melnikov 29 Oct. 1973 12 p refs Transl. into ENGLISH from the publ. "Gorenie i Vzryv" (USSR), 1972 p 44-48
(AD-769983; FTD-HT-23-621-74) Avail: NTIS CSCL 21/2

Theories concerning the initiation of inorganic azides by an electric spark are discussed. Thermal effects connected with the development of the discharge channel are described. It is stated that intiation of the reaction occurs only when a certain amount of energy is released in the spark channel. A second theory is based on the rapid reactions of the excited particles and the nonthermal mechanism of excitation on the detonation wave is assumed possible. Author (GRA)

N74-17653# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORY OF THE STABILITY OF POWDER BURNING
O. Ya. Romanov and G. G. Shelukhin 30 Oct. 1973 11 p refs Transl. into ENGLISH from the publ. "Gorenie i Vzryv" USSR, 1972 p 94-99
(AD-769987; FTD-HT-23-632-74) Avail: NTIS CSCL 21/2

In existing theories on the low frequency stability of burning only the inertness of the heated layer of the condensed phase (k phase) is taken into account in the nonstationary burning process. Since real powders can have an extended reaction zone during burning, it is expedient to consider its inertness. By comparing the relaxation times of the processes occuring during burning, assuming noninertness of the heating zone in the gaseous phase and a thin layer of k phase having a thickness on the order of the diameter of a gas bubble in the k phase, the dispersion zone in which extraction of the substance of the k phase occurs is described. Author

N74-17654# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LIMITING CONDITIONS OF COMBUSTION PROPAGATION ALONG METAL SAMPLES IN GASEOUS OXYGEN
B. A. Ivanov, E. M. Izmailov, S. E. Narkunskii, A. P. Nikonov, and V. F. Pleshanov 7 Nov. 1973 12 p refs Transl. into ENGLISH from the publ. "Gorenie i Vzryv" USSR, 1972 p 148-152
(AD-770463; FTD-HT-23-645-74) Avail: NTIS CSCL 07/4

The aim of this work is to establish an interrelationship among the parameters characterizing the limiting conditions of combustion propagating along metal samples in pure gaseous oxygen. GRA

N74-17655# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE GAS-FREE BURNING OF A MIXTURE OF METAL

POWDERS
V. I. Itin and Yu S. Naiborodenko 30 Oct. 1973 12 p refs Transl. into ENGLISH from the publ. "Gorenie i Vzryv" USSR, 1972 p 142-147
(AD-770465; FTD-HT-23-644-74) Avail: NTIS CSCL 07/4

The article is devoted to a study of the gas-free burning of mixtures of Ni-Al and Cu-Al powders, the kinetics of reaction diffusion in these mixtures, and the process of the increase in volume of the briquets due to the formation of new phases. GRA

N74-17656# Army Foreign Science and Technology Center, Charlottesville, Va.
THE 2ND ALL-UNION SYMPOSIUM ON COMBUSTION AND EXPLOSION
U. N. Panfilov 14 Aug. 1973 6 p Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 6, no. 2, 1970 p 256-258
(AD-769997; FSTC-HT-23-1746-72) Avail: NTIS CSCL 21/2

Subjects discussed at this 1969 conference included the following: Kinetics of reactions in gas and condensed phases; relaxation processes and kinetics of impact wave reactions; ignition and combustion of gases and condensed systems; heterogeneous combustion; impact wave physical phenomena and chemical conversions; and, detonation of condensed explosives. GRA

N74-17657# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBUSTION MECHANISM OF AMMONIUM AND HYDRAZONE SALTS
G. B. Manelis and V. A. Strunin 6 Nov. 1973 14 p refs Transl. into ENGLISH from the publ. "Gorenie i Vzryv" USSR, 1972 p 53-57
(AD-769981; FTD-HT-23-623-74) Avail: NTIS CSCL 07/4

Many salts of ammonia and hydrazone (for example, perchlorates, nitrates) are capable of self-contained combustion. A characteristic feature of these compounds is the rather high rate of reaction of the decomposition in the condensed phase and the capacity for vaporization. The translation discusses the reaction kinetics. GRA

N74-17658# Washington Univ., Seattle. Dept. of Chemistry.
COLLISIONAL MOLECULAR ENERGY TRANSFER CHARACTERISTIC OF COMBUSTION Final Report, 1 Oct. 1969 - 30 Sep. 1973
B. S. Rabinovitch 30 Sep. 1973 8 p refs
(Contract F44620-70-C-0012; AF Proj. 9538)
(AD-770683; AFOSR-73-2004TR) Avail: NTIS CSCL 07/4

The report summarizes the experimental and theoretical accomplishment under this program which deals with collisional energy transfer involving polyatomic molecules at high vibrational levels characteristic of reaction and combustion. Author (GRA)

N74-17659# Illinois Univ., Urbana. Charged Particle Research Lab.
THE MASS AND CHARGE LOSS OF MACROSCOPIC DROPLETS IN A FLAME
Kam F. Yeung and Charles D. Hendricks Jul. 1973 85 p refs
(Grant AF-AFOSR-1508-68; AF-AFOSR-2481-73)
(AD-770656; CPRL-2-73; AFOSR-73-2077TR;
UILU-ENG-73-2551) Avail: NTIS CSCL 21/2

Macroscopic droplets of radius in the range of one mm were injected into an air-acetylene flame. The evaporation and combustion theories of droplets were presented. The interaction of charged droplets with the ions in a flame was also investigated. Both mass and charge loss of droplets through a flame were measured. Sodium D line technique was employed to measure the temperature of the flame. Various techniques of charge and mass measurement are also discussed. (Modified author abstract) GRA

N74-17663 Joint Publications Research Service, Arlington, Va.
ROLE OF THERMOENERGETIC RESEARCH IN SAVING FUEL
Teofil Popovici and D. Marian *In its* Transl. on Eastern Europe Sci. Affairs, No. 383 (JPRS-61101) 30 Jan. 1974 p 24-26 Transl. into ENGLISH from Romania Libera (Bucharest), 18 Nov. 1973 2 p (For availability see N74-17661 08-34)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-17660 Central Electricity Generating Board, London (England).
ECONOMETRIC MODELS: THEIR APPLICATION TO THE ECONOMIC AND ENERGY SECTORS
G. G. Kinnane, comp. Dec. 1973 26 p refs
(CE-Bibl-220) Avail: Issuing Activity

A bibliography of abstracts on econometric models and their application to the economy and energy sectors is presented. The bibliography has 101 references. E.H.W.

N74-17661# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 383
30 Jan. 1974 29 p refs Transl. into ENGLISH from various East European periodicals
(JPRS-61101) Avail: NTIS HC $3.50

Romanian research is reported in the areas of: (1) digital processing and transmission of information, and (2) fuel savings with thermoenergetic equipment. For individual titles, see N74-17662 through N74-17663.

N74-17662 Joint Publications Research Service, Arlington, Va.
ACADEMY SESSION ON DIGITAL PROCESSING AND TRANSMISSION OF INFORMATION c08
In its Transl. on Eastern Europe Sci. Affairs, No. 383 (JPRS-61101) 30 Jan. 1974 p 13-18 Transl. into ENGLISH from Posta si Telecomunicatii (Bucharest), no. 10, Oct. 1973 p 472-573 Conf. held at Bucharest, 4-6 Oct. 1973 (For availability see N74-17661 08-34)

Brief summaries are given of reports presented at the scientific session of the Academy. The reports include information on technical development studies and specific achievements realized by data transmission installation. D.L.G.

N74-17663 Joint Publications Research Service, Arlington, Va.
ROLE OF THERMOENERGETIC RESEARCH IN SAVING FUEL c33
Teofil Popovici and D. Marian *In its* Transl. on Eastern Europe Sci. Affairs, No. 383 (JPRS-61101) 30 Jan. 1974 p 24-26 Transl. into ENGLISH from Romania Libera (Bucharest), 18 Nov. 1973 2 p (For availability see N74-17661 08-34)

A question and answer interview with the director of the Romanian Research and Design Institute for Thermoenergetic Equipment is reported. The interview involves proposals of concrete methods by which researchers and designers of thermoenergetic equipment can help to better use the fuel in the national economy. Author

N74-17664# Advisory Group for Aerospace Research and Development, Paris (France).
DIRECTORY OF RESEARCH ACTIVITIES ON IN-SITU COMPOSITES
Oct. 1973 21 p refs Prepared by Battelle Columbus Labs.
(AGARD-R-609) Avail: NTIS HC $3.25

A directory of research facilities, laboratories, and corporations conducting research on composite materials is presented. The organizations are identified by the country in which located and the principal respondents are identified. A brief statement concerning the type of research being conducted accompanies each entry where applicable. Author

N74-17665*# Purdue Univ., Lafayette, Ind.
MATERIALS SCIENCES RESEARCH Progress Report, 1 Oct. 1972 - 30 Sep. 1973
30 Nov. 1973 276 p refs Sponsored in part by NASA
(Grants NSF GH-33574; NSF GH-33574-A1)
(NASA-CR-136819; PR-12) Avail: NTIS HC $16.00 CSCL 05A

Research projects involving materials research conducted by various international test facilities are reported. Much of the materials research is classified in the following areas: (1) acousto-optic, acousto-electric, and ultrasonic research, (2) research for elucidating transport phenomena in well characterized oxides, (3) research in semiconductor materials and semiconductor devices, (4) the study of interfaces and interfacial phenomena, and (5) materials research relevant to natural resources. Descriptions of the individual research programs are listed alphabetically by the name of the author and show all personnel involved, resulting publications, and associated meeting speeches. Author

N74-17666# Bureau of Mines, Washington, D.C. Office of Economic Analysis.
DETERMINING THE EFFECTS OF GASOLINE PRICE ON USE OF METALS IN AUTOMOBILE MANUFACTURE
Phillip N. Yasnowsky and Donald S. Colby 1974 18 p refs (BM-RI-7871) Avail: NTIS HC $4.00

An attempt was made to relate the size of automobiles to the price of gasoline, and the use of minerals in automobile manufacture to the size of automobiles. Only one of the many plausible scenarios of public reaction to higher gasoline prices, a switch to economy size automobiles, is developed. No account is taken of other potential impacts such as improvements in public transportation or increased occupancy per vehicle. Futhermore, a gasoline price increase is the only incentive to the greater utilization of economy cars that is considered. A gasoline price increase to $0.60 per gallon would reduce the amount of minerals required to produce the automobiles sold in the United States by an estimated 15 percent. Gasoline prices of $0.80 and $1 per gallon would cause declines in mineral requirements for U.S. automobile sales estimated at 26 percent and 35 percent, respectively. Author

N74-17667*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A CONTEMPORARY VIEW OF SYSTEMS ENGINEERING
Ralph F. Miles, Jr. 15 Jan. 1974 23 p
(Contract NAS7-100)
(NASA-CR-136833; JPL-TM-33-667) Avail: NTIS HC $4.25 CSCL 12B

The concept of a 'system' is defined, and the 'systems approach' is discussed. Four contemporary examples of the systems approach are presented: an operations research project, the planning-programming-budgeting system, an information processing system, and aerospace programs. Author

N74-17668*# Washington Univ., St. Louis, Mo. Center for Development Technology.
TECHNOLOGY IN THE PUBLIC SCHOOLS?
Dale Lipman Dec. 1973 98 p refs
(Grant NGR-26-008-054)
(NASA-CR-136829; Memo-73/6) Avail: NTIS HC $8.00 CSCL 05I

An evaluation of the forces operating on the public schools which might influence their disposition toward the utilization of technology is presented. It is suggested that the wide-ranging technology and know-how generated by the Federally sponsored research and development programs can be adapted and applied to the solution of problems found in education. It is suggested that three major developments in society have great bearing on the utilization of technology in educational programs. The extent to which these factors are manifested and interrelated, and the potential significance of their combined impact are analyzed. Author

N74-17669# Committee on Interior and Insular Affairs (U. S. Senate).
A REVIEW OF ENERGY POLICY ACTIVITIES OF THE 92D CONGRESS
1973 87 p refs Presented to Comm. on Interior and Insular Affairs, 93d Congr., 1st Sess., 30 Dec. 1972 Prepared by Library of Congr.
Avail: Comm. on Interior and Insular Affairs

The provision of an adequate supply of all needed forms of energy at reasonable and stable prices, with incentive for their continued adequate provision, without degradation of the environment or jeopardy to the national security, and with minimum waste is discussed. Three basic areas are discussed: the legislation that was enacted; the legislation that was proposed but not enacted; and the hearings that were held by the various committees and subcommittees of the Congress. In addition, reports concerning energy that were issued are included. Author

N74-17670# Mullard Research Labs., Red Hill (England).
ANNUAL REVIEW 1972: A SELECTION OF SHORT ARTICLES DESCRIBING SOME OF THE PROJECTS CARRIED OUT IN THE LABORATORIES DURING THE YEAR
1972 125 p refs
Avail: NTIS HC $9.25

Articles are presented on research work. Progress in the following areas is outlined: (1) interferometer design for measuring very low aircraft approach angles; (2) molecular beam epitaxy; (3) ion implantation; (4) ferroelectric, magneto-optic, and magnetic materials; (5) devices and integrated circuits in the microwave spectrum; (6) power handling capacity of GaAs Gunn diodes; (7) electron beam technology for semiconductor fabrication; (8) precision chemical milling; and (9) computer aided design. S.K.W.

N74-17671# National Aeronautical Lab., Bangalore (India).
CURRENT RESEARCH PROGRAMMES (1973)
Aug. 1973 42 p refs
Avail: NTIS HC $5.25

Summaries are presented for 92 research projects oriented towards the needs of aerospace industry. The major subject areas covered are aerodynamics, propulsion, structural sciences, materials science, electronics, instrumentation, mathematical sciences, and pilot plants. S.K.W.

N74-17672# Ecole Nationale Superieure de Mecanique, Nantes (France).
ANNALS 1972, SECOND TERM [ANNALES 1972, DEUXIEME SEMESTRE]
1972 195 p refs In FRENCH
Avail: NTIS HC $12.75

Selected articles dealing with Kalman filtering used in linear prediction are presented along with data on properties of composite materials. Applications of Kalman filtering to ship platform movement and Kossel pattern method to copper trichites patterns are discussed in detail. For individual titles, see N74-17673 through N74-17678.

N74-17673 Ecole Nationale Superieure de Mecanique, Nantes (France).
STUDY OF UNIDIRECTIONAL COMPOSITE MATERIALS USING THE FINITE ELEMENT METHOD [CONTRIBUTION A L'ETUDE DES MATERIAUX COMPOSITES UNIDIRECTIONNELS A PARTIR DE LA METHODE DES ELEMENTS FINIS] **c18**
B. Peseux and B. Sirot *In its* Ann. 1972, Second Term 1972 p 33-46 refs In FRENCH (For availability see N74-17672 08-34)

The determination of the equivalent longitudinal and transversal elasticity modules for unidirectional composite materials is presented, using the finite element method. Under the hypothesis of Hook's law for both fibers and matrix and assuming perfect coupling, the computer program FILEM3 leads to the shear stress variation curves and normal stress concentration in the neighborhood of the fiber. ESRO

N74-17674 Ecole Nationale Superieure de Mecanique, Nantes (France).
EXPERIMENTAL DETERMINATION OF AN OPTIMAL PREDICTIVE FILTER [DETERMINATION EXPERIMENTALE D'UN FILTRE PREDICTEUR OPTIMAL] **c19**
C. Doncarli and P. DeLarminat *In its* Ann. 1972, Second Term 1972 p 67-72 refs In FRENCH (For availability see N74-17672 08-34)

An algorithm for direct identification of a predictive filter following Kalman theory is described. The method is an extension of the work by Mehra which allowed for the optimal estimating filter gain determination from output process measurements without a priori knowledge of the random noise properties. The

present method eliminates the Mehra requirements of regularity for the state transition matrix and independence between the state and output noises. ESRO

N74-17675 Ecole Nationale Superieure de Mecanique, Nantes (France).
DEFINITION AND APPLICATIONS OF A FILTERING CRITERION WITH VARIABLE TIME SPAN [DEFINITION ET APPLICATIONS D'UN CRITERE DE FILTRAGE A HORIZON MOBILE] c19
Philippe DeLarminat *In its* Ann. 1972, Second Term 1972 p 133-149 refs In FRENCH Presented at the LAAS-GRETSI Conf. on le Filtrage Numerique et ses Appl., Toulon, France, 1-2 Jun. 1972 (For availability see N74-17672 08-34)

A deterministic criterion for Wiener or Kalman like filtering is described where only the output deviations are considered with time exponential weighting depending on a time span factor directly linked to the filter time response. The resulting filtering equations exhibit a Kalman-like structure and their solution is readily accessible. The theory is detailed with regard to the interpretation of the variable time span factor introduced. Applications such as estimation and prediction of a platform roll movement, estimation of buffeting from acceleration measurements, and real time identification of a nonstationary system are discussed. ESRO

N74-17676 Ecole Nationale Superieure de Mecanique, Nantes (France).
SHIP PLATFORM MOVEMENT PREDICTION BY SELF ADAPTIVE FILTERING [PREDICTION DES MOUVEMENTS DE LA PLATEFORME D'UN NAVIRE PAR FILTRAGE AUTOADAPTIF] c19
C. Bozzo, (GESSY, Centre Univ. de Toulon, France), B. Cavallo, (GESSY, Centre Univ. de Toulon, France), and P. DeLarminat *In its* Ann. 1972, Second Term 1972 p 151-161 ref In FRENCH Presented at the Automatica 1972 Congr., Barcelona, 18-20 Oct. 1972 (For availability see N74-17672 08-34)

The continuous prediction of a ship platform (pitch and roll) by means of self adaptive filtering is presented. Two distinct applications of the variable time span filtering criterion are used. The first step performs a nonadaptive predictive filter independent of the statistical characteristics of the movements by extrapolation of a polynomial curve fitting of past movements. The adjustment criterion is weighted exponentially in the past and the polynomial coefficients recusively calculated after each measurement. In the second step the filter parameters are adapted in real time thus improving performances. Cross correlation between the movements is taken into account. The method is amenable to hardware embodiments suitable for onboard computers. ESRO

N74-17677 Ecole Nationale Superieure de Mecanique, Nantes (France).
FINE STRUCTURE STUDIES BY KOSSEL PATTERNS [ETUDE DES STRUCTURES FINES PAR LES DIAGRAMMES DE KOSSEL] c17
Man Hoat Nguyen and S. Offret *In its* Ann. 1972, Second Term 1972 p 163-172 refs In FRENCH (For availability see N74-17672 08-34)

A presentation of the Kossel pattern method is detailed. The production and geometry of the Kossel lines are discussed together with the Pitsch method on the stereographic projection method for Kossel line indexing. Data are also given on crystal orientation, various parameter determination methods, and applications to copper trichites. ESRO

N74-17678 Ecole Nationale Superieure de Mecanique, Nantes (France).
TUNGSTEN OXIDE THIN FILM PROPERTIES IN ALTERNATING CURRENT [PROPRIETES DES COUCHES MINCHES D'OXYDE DE TUNGSTENE EN COURANT ALTERNATIF] c17
K. H. Kim *In its* Ann. 1972, Second Term 1972 p 181-191 refs In FRENCH (For availability see N74-17672 08-34)

Dielectric properties of tungsten oxides thin film under alternating current are discussed. The oxide is prepared from 3N grade Wo3 by sublimation and vacuum deposition onto heated glass. The temperature and frequency dependence of the following parameters are detailed: parallel capacitance loss angle and specific resistivity. Interpretation of the measurements is discussed. ESRO

N74-17679# Hungarian Academy of Sciences, Budapest.
YEARBOOK, 1972
1972 156 p refs
(NP-19833) Avail: AEC Depository Libraries HC $10.00

Theoretical and experimental research on high energy and nuclear physics, optics, solid state physics, chemistry, nuclear energy, electronics, computing techniques, and research development and engineering of experimental equipment is summarized. A list of publications is included. NSA

N74-17680# Oak Ridge National Lab., Tenn.
NSF-RANN ENERGY ABSTRACTS: A MONTHLY ABSTRACT JOURNAL OF ENERGY RESEARCH
M. P. Guthrie, ed. Sep. 1973 24 p refs Sponsored in part by NSF
(Contract W-7405-eng-26)
(ORNL-EIS-73-52-Vol-1-No-9) Avail: NTIS HC $3.25

One-hundred abstracts are presented of recently published articles on energy resources; energy conversion: energy production, consumption, economics, and policy; electric power production consumption, and transmission; and environmental studies related to power production and use. Each abstract is accompanied by the following information: title; author; corporate author with address; publication description; publication date; research sponsor; and availability. NSA

N74-17681# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY OF AN AEROSAT SYSTEM: EXAMPLE OF DIVISION OF LABOR [ETUDE D'UN SYSTEME AEROSAT: EXEMPLE DE REPARTITION DU TRAVAIL]
Claude Skenderoff 1973 15 p In FRENCH Presented at the 13th European Space Symp., London, 25-27 Jun. 1973 Sponsored by ESRO
Avail: NTIS HC $4.00

Aerosat project systems for air traffic control and aircraft communication over the Pacific and Altantic oceans were analyzed. The distribution of work between American and European firms is reported. Technical results obtained and solutions for optimization of the satellite and payload configurations are outlined. ESRO

N74-17682# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
EUROPEAN PARTICIPATION IN THE DEFINITION OF THE NEXT GENERATION COMMUNICATION SATELLITE
B. Blachier 19 Jun. 1973 13 p Presented at the 13th European Space Symp., London, 25-27 Jun. 1973
(DFH-BS-1.622/73/BB.MB) Avail: NTIS HC $4.00

A study to define the new generation Intelsat 5 communication package is given, along with traffic requirements. Traffic matrix for the Atlantic and Pacific zones for the 1983 period are compared and show that some arrangements should be provided in order that the same satellite be capable of working over any ocean. Salient features of Atlantic traffic are analyzed. Intelsat 5 transponder plans are investigated. The number of transponders for each plan for different types of launcher is determined, and the polarization is chosen. The optimal communications packages suitable for the technology satellite Intelsat 5 is defined. ESRO

N74-17683# Krauss-Maffei A.G., Munich (West Germany).
TRANSRAPID: APPLICATIONS OF INTEGRATED ELECTROMAGNETIC SUSPENSION TECHNIQUE [TRANSRAPID: ANWENDUNG INTEGRIERTER ELEKTROMAGNETSCHWEBETECHNIK]
Hans-Dietrich VonBernuth 1973 14 p In GERMAN Presented at the DGLR Symp. Moeglichkeiten eines Spurgebundenen Hochgeschwindigkeitsverkehrs, Bonn, 6 Nov. 1973
(DGLR-Paper-73-156) Avail: NTIS HC $4.00

Magnetic suspension systems, based on the application of electronically controlled electromagnets, are considered, including transrapid technology. In this system, the distance between a coil and an iron body is measured with a sensor, which transmits this information to a regulator which varies the electromagnet

current. The electromagnet is fixed to a vehicle, and the iron body is the rail. As the principle is based on attraction forces, the electromagnets are placed underneath the rails, which also prevents derailing. ESRO

N74-17684# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Zentralbereich Entwicklungen.
ELECTROMAGNETIC SUSPENSION TECHNIQUE WITH SEPARATED SUPPORT AND GUIDANCE SYSTEMS [ELEKTROMAGNET-SCHWEBETECHNIK MIT GETRENNTEN TRAG- UND FUEHRUNGSSYSTEMEN]
Hans Fabian 1973 9 p In GERMAN Presented at the DGLR Symp. Moeglichkeiten eines Spurgebundenen Hochgeschwindigkeitsverkehrs, Bonn, 6 Nov. 1973
(DGLR-Paper-73-157) Avail: NTIS HC $4.00

A technique for separate control of the support and guidance systems of an electromagnetic suspension for rail transportation is described. The separation of controls for lateral perturbing forces, such as from gusts, beginning of curves, etc., was achieved in the lateral guidance systems and the supporting electromagnets. Test results of a prototype vehicle based on this technique are reported. ESRO

N74-17685# Technische Hogeschool, Delft (Netherlands).
AVIATION NEEDS AND PUBLIC CONCERNS
Emile VanLennep (Organ. for Econ. Co-operation and Develop., Paris) 1973 39 p Presented at 7th Dr. Albert Plesman Memorial Lecture, Delft, Neth., 29 Oct. 1973
Avail: NTIS HC $5.00

The seventh Dr. Albert Plesman Memorial Lecture deals with the problems of aviation needs and public concerns. The problems of aircraft noise, and its reduction, are discussed. The growing demands on energy resources are coupled with the rising fuel prices. The growing scarcity of land suitable for airport sites is illustrated. Some background data is provided from related OECD studies. ESRO

N74-17686# California Univ., Los Angeles. Western Management Science Inst.
INFORMATION, DECISION AND THE SCIENTIST
Jacob Marschak Sep. 1973 45 p refs
(Contract N00014-69-A-0200-4005)
(AD-769145; WMSI-Working-Paper-206) Avail: NTIS CSCL 05/1

A decision-theoretical critique of semantic information measure and other suggestions made by students of inductive logic leads to a formal statement of sequence: (1) What problem should I study, (2) What set of mutually exclusive and exhaustive hypotheses shall I test, (3) What kind of evidence shall I use, and (4) What hypothesis shall I accept. (Modified author abstract) GRA

N74-17687# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERSONAL VALUES OF RESEARCH AND DEVELOPMENT PROFESSIONALS AND OPERATIVE GOALS IN RESEARCH AND DEVELOPMENT ORGANIZATIONS: AN IN-DEPTH ANALYSIS OF ONE LABORATORY M.S. Thesis
Eugene W. Pittenger Dec. 1973 212 p refs
(AD-769190; GSM/SM/73-27) Avail: NTIS CSCL 05/10

Purpose of study was to add to understanding of organizational goals of R-D organizations and of personal value systems of professional personnel in R-D organizations. The approach was to develop a set of value concepts meaningful to R-D professionals, develop a set of goals potentially important to R-D organizations, incorporate value concepts, goals, and demographic variables in a questionnaire, and administer the questionnaire to professional members of the Air Force Cambridge Research Laboratories determine primary orientation of professionals through analysis of ratings given value concepts, and use primary orientation and importance ratings to determine value concepts with behavioral relevance to professionals of the organization, and determine operative goals of the organization; and compare operative goals with formal goals. (Modified author abstract) GRA

N74-17688# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDIES OF THE ARTIFICIAL CONTROL OF PRECIPITATION RELATIVE TO THE PROBLEM OF EXTINGUISHING FOREST FIRES
L. N. Dyachenko, Yu P. Sumin, and N. S. Shishkin 8 Nov. 1973 15 p refs Transl. into ENGLISH from Tr. v Vsesoyuzn ogo Meteorologicheskogo Sezda. Sekts. Aktiv. Vozdeistvii na Atm. Protesessy, (USSR), v. 4 1972 p 37-44
(FTD Proj. T74-01-20)
(AD-770453; FTD-MT-24-214-74) Avail: NTIS CSCL 02/6

Studies have shown the possibility of using artificial precipitation for extinguishing forest fires, and it has been subjected to broad experimental verification. The method of extinguishing forest fires with artificially-induced precipitation is applicable only when there is sufficiently thick convective cloud cover over the operations regions. Therefore, it is not universal and cannot be used as a substitute for ground methods. The proposed method is very economical. GRA

N74-17689# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TOWARD THE DEFINITION OF ESCAPE AND CAPTURE REGIONS FOR A TWO AIRCRAFT PURSUIT-EVASION GAME M.S. Thesis
P. H. Cawdery Jun. 1973 78 p refs
(AD-770281; GA/MC/73-4) Avail: NTIS CSCL 15/7

The motivation for the thesis originates in research currently being conducted at the USAF Armament Laboratory, Eglin AFB, Florida. These studies concern the performance of an F4-E aircraft in air-to-air combat; the weapon system considered is an infra-red, heat-seeking missile. The studies fall into two categories: (a) Definition of those regions in the vicinity of a target aircraft which the attacker must penetrate in order to attain a probability of killing his opponent greater than zero; definition of optimal strategies for the attacker to intercept and penetrate the high probability of kill P sub K regions. In all cases, the target aircraft is considered as passive and unaware of attack. This paper makes the logical extension to the above research, and attempts to develop a method by which the capability of the attacker may be defined against an intelligent and evasive target. (Modified author abstract) GRA

N74-17690# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 27, NUMBER 7
Arthur W. Frisch and Victoria Hewitson 31 Jul. 1973 40 p refs
(AD-766727; ESN-27-7) Avail: NTIS CSCL 05/2

Brief articles on recent developments in European scientific research are presented. The following areas are discussed: behavioral sciences, biomedicine, chemistry, earth science, industrial and mechanical engineering, medicine, and oceanography. S.K.W.

N74-17691# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[RESEARCH IN GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATIONS] Quarterly Progress Report
H. J. Zimmermann, G. G. Harvey, and S. J. Mason 15 Oct. 1973 166 p refs
(Contract DAAB07-71-C-0300)
(AD-769891; QPR-111) Avail: NTIS CSCL 05/2

Contents: Microwave spectroscopy; radio astronomy; electrodynamics of media; plasmas and controlled nuclear fusion; gaseous electronics; applied plasma research; processing and transmission of information; linguistics; cognitive information processing; neurophysiology; signal processing; digital signal processing. GRA

N74-17692# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PROBLEMS ENCOUNTERED IN IMPLEMENTING DESIGN TO A COST IN MAJOR AIR FORCE WEAPON SYSTEM ACQUISITION PROGRAMS M.S. Thesis
Stephen A. Hamer Oct. 1973 106 p refs
(AD-769912; GSM/SM/73-11) Avail: NTIS CSCL 05/1

Increasing pressure to reduce defense spending has encouraged new approaches to managing weapon system acquisition and ownership costs. The design to a cost concept is one of the newest approaches to cost reduction in DoD. Design to a cost is the process of controlling cost by treating an established

cost target as a parameter of equal importance with system performance. Problems which have been identified as being caused by design to a cost fall in the categories of communication, culture, operation and applicability. (Modified author abstract)
GRA

N74-17693# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERATURE, AUGUST 1973
Stuart G. Hibben 15 Oct. 1973 62 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-4)
(AD-770640; AFOSR-73-2080TR) Avail: NTIS CSCL 05/2
The report includes bibliographic lists on contractual subjects that were completed in August 1973. The major topics are: laser technology, effects of strong explosions, geosciences, particle beams, and material sciences. A section of bionics and one on items of miscellaneous interest are included as optional topics. Laser coverage is generally limited to high power effects: all current laser material is routinely entered in the quarterly laser bibliographies. An index identifying source abbreviations is appended. Author (GRA)

N74-17694# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 27, NO. 3
James T. Lester and Victoria S. Hewitson 30 Mar. 1973 35 p
(AD-759356; ESN-27-3) Avail: NTIS CSCL 05/2
The monthly publication presents brief articles concerning recent developments in European Scientific Research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American Scientists by disclosing interesting information well in advance of the usual scientific publications. The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist. Author (GRA)

N74-17695# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 27, NUMBER 6
James T. Lester, ed. and Victoria S. Hewitson, ed. 30 Jun. 1973 37 p
(AD-765256; ESN-27-6) Avail: NTIS CSCL 05/2
For abstract See N74-17694.

N74-16931 Transociates Ltd., London (England).
EDUCATION AND TECHNICAL TRAINING FOR TECHNICAL INFORMATION
Felix Liebesny *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 3 p refs (For availability see N74-16925 08-08)

N74-16932 Greater London Council (England).
MICROFILM AND REPROGRAPHIC SYSTEMS: A STATE OF THE ART REVIEW
Thomas J. Morgan *In* AGARD New Develop. in Storage, Retrieval and Dissemination of Aerospace Inform. Dec. 1973 5 p (For availability see N74-16925 08-08)